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Wearable Technology: Improving Exercise Habits and Experiences in Adults

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Abstract

This study examines the effects of wearable technology devices on adult participants' attitudes toward physical activity. The Attitudes Toward Computers Questionnaire (ATCQ) was used as a multidimensional measure for this study. This quantitative study used a pre and post survey instrument with the implementation of the Moov Multi-Sport Wearable Coach for a two-week period. Participants of this study included 34 adults above the age of 18. Data was analyzed using independent *t*-tests, paired sample *t*-tests, and descriptive discriminant analysis to compare the seven dimensions of attitude. Dehumanization scores increased significantly from pre to posttest. Also, efficacy scores for younger adults were significantly lower than in older adults. Finally, gender scores for younger adults and females in the posttest were significant, and can be used to predict age groups in the sample population.

Keywords: physiological aging; wearable technology devices, aerobic activity, muscle strengthening activity

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1.Background/Introduction

It is important to have healthy exercise habits throughout all ages in life. However, declining activity rates in older age coupled with physiological aging and an increased risk for onset of chronic diseases make exercise even more important for older adults. Older persons benefit greatly from regular exercise, which may reduce risk of chronic disease, reduce illnesses, increase physical and mental functionality, reduce falls, and increase potential of a longer life (Bennett, 2011). This is why, as a physical activity motivator, it is important to provide individuals with the necessary tools to set and accomplish their goals. With the growing industry of sports performance devices (wearable technology devices), designers need to create a device that meets the needs of these individuals, and be aware of current trends, and desires of their users. A number of wearable devices have been introduced to consumers such as the Moov, Fitbit, and Apple Watch. In this study, the Moov multi-sport wearable coach was used to gather information on attitude change towards technology, before and after use of the Moov device. More specifically, the researchers investigated the perception of the users of these devices, and how they assist in promoting exercise.

Wearable technology devices could be powerful tools in promoting healthy behaviors in users of all ages. A study was conducted by Utah University State University, on K-12 students, and how the devices could be used to help students learn both content related to statistics and about physical activity in general (Lee et. al, 2015). This study was designed to show that wearable technology devices could not only promote healthy exercise habits, but also teach children necessary content related to mathematics, which would promote classroom learning. Regular exercise is essential for older adults as well. Therefore, if designed and promoted correctly, wearable devices could potentially motivate older persons to the recommended level of activity. The devices track progress, and show adults who may not be very familiar with exercise, the proper technique and intensity that they need to perform. In a study conducted by Resnick (2007), a seven-step approach was provided to motivate older adults. These seven steps included education, screening, goal identification, elimination of barriers, role models, verbal encouragement, and reinforcement and rewards. In order to be effective, wearable devices need to include some form of each of these approaches. Most importantly, to motivate adults of any age, proper goal setting, verbal encouragement, and reinforcement are essential.

Each of these devices has numerous features, some of which simplify the exercise experience for users. The Apple Watch, for example, provides the ability to track steps, heart rate, make phone calls on smart phones, perform text messaging, and check emails (Apple, Inc., 2015). Efforts have been made to provide a quality product to consumers, but it is important for manufacturers to continue to search for trends, make improvements to these products, and understand what the consumer requires. In order to do so, it is important to research these wearable technology devices, and observe the perceptions of the users. This investigation focused specifically on the

Moov wearable technology device, and employed a quantitative, descriptive study design using a pre and post survey, to determine the effect of the wearable technology devices on adult attitudes towards technology.

1.1 Purpose

The purpose of this study was to introduce adults to wearable technology devices, and examine their attitudes toward these devices. Fitness product designers, and fitness industry professionals need to determine how older adults can be motivated to positively change their exercise behaviors and stay active as they age. For overall cardiovascular health, The American Heart Association (AHA) (2015) recommends at least 30 minutes of moderate to intense aerobic activity at least five days per week, or at least 25 minutes of vigorous aerobic activity at least three days per week. Also, the AHA recommends performance of moderate to high intensity muscle strengthening activity at least two days per week for additional health benefits. It is important for older persons to be motivated to meet these guidelines in order to live healthier lives. Toward this end, wearable technology device designers need to address these recommendations, and make their devices effective in their users' daily lives. It has been shown that older adults were more likely to start and continue an exercise program if it had been recommended by a health professionals (Groot, 2011). This is a sign that wearable technology devices could be of great benefit used by health professionals working with clients.

1.2 Research Questions

The research questions for the study are as follows:

1. Do wearable technology devices have an effect on participant's attitudes toward exercise?
    a) How do young adults compare against older adults?
    b) How do men compare against women?
2. Is there any significant difference in the seven dimensions (comfort, efficacy, gender equality, control, dehumanization, interest and utility) of attitude change between participants?
    a) How do young adults compare against older adults?
    b) How do men compare against women?

1.3 Significance

In order for adults to successfully initiate and maintain positive health and wellness behaviors, they need to be provided with the necessary tools and information. The growing industry of wearable technology devices may provide such tools, but they must be tested for their effectiveness in promoting health-fitness behaviors. It is essential to have the opportunity to continue to expand these products, and provide more effective devices. It is also believed that data from these technologies may provide a purpose for alternative settings, such as classroom or schoolyard (Lee et al., 2015). In order to better understand the potential benefits, there has to be better understanding of how these devices work, and what features provide the greatest benefit to users. The results of this study may provide such understanding and further insight on wearable technology and contribute to improve the design of future wearable technology devices.

2.Review of Literature

Wearable technology devices are a fast growing resource in the field of health and fitness, which help to motivate individuals to be more physically active. In recent years devices have included performance monitors (activity and heart rate), and have continued to expand into smart glasses, smart watches, smart clothing, among many others. These trends in advancement have, and will continue to impact professional athletes, fitness consumers, corporate wellness, and chronic disease management. Prices range anywhere from a few dollars for very basic devices, up to hundreds of dollars for the most high tech devices. These devices have the ability to track all aspects of daily activity. The key to these devices is the ability to properly motivate users to be more health conscious of their bodies. There are many forms of technology that work to provide a solution to this problem. A variety of smartphone apps, exergames, and the above mentioned, wearable technology devices are some of the current marketed technologies. These devices offer features, which motivate users to increase physical activity levels, improve eating habits, and monitor sleep habits. These are the three key factors, which contribute to a healthy lifestyle. With all of these devices potentially accessible by almost everyone, they are a viable way to battle the growing health concerns in today's society. When marketing these technologies, it is important to reach all age groups with different devices. It is important to target children to start beneficial health and fitness routines, as well as young adults who are transitioning into adulthood, and older adults who are beginning to experience more health risk factors. For this reason, it is very important that wearable technology designers are aware of the current trends in today's society, and be able to create a device that can be useful, and improve the lives of their users. A review of literature has been done to look at the aspect of motivating individuals, how technology is influencing our lives, the impact of physical activity for long-term health, and how business affects these devices and their users.

2.1 Motivation

Motivation is an important factor in adult's ability and willingness to participate in functional activities and engage in regular exercise (Resnick, 2007). In the education setting, and physical activity training setting, it can be very difficult to properly motivate individuals to exercise regularly. For this reason, it is important to understand the basic concepts of motivation, and how to implement them in an educational setting. According to Resnick, as motivators, we tend to focus on individuals who come willingly to participate in physical activity, rather than motivating individuals who do not come willingly. Motivating people to follow a program of regular exercise remains a critical and unmet challenge in the 21^{st} century (Phillips, Schneider, & Mercer, 2004). In order to explore the challenges faced by adults, we need to develop a systematic approach for counseling these adults to a higher rate of physical activity throughout their lives. Factors that influence motivation includes efficacy expectations, physical benefits, psychosocial benefits, something different, individualized care, removal of unpleasant sensations, removal of barriers, and goals (Resnick, 2007).

A study by Randelovic and Todorovic looked at the relations between certain types of motivation and self-orientation (Randelovic & Todorovic, 2015). The main goal of this research is to examine relations between certain types of motivation (intrinsic and extrinsic) and self-orientation, which is defined by the assumptions of the self-determination theory (integrated self, ego-invested self, impersonal self). Social environment can encourage or hinder the natural ability of the self to realize its potential. Motivation, which is basically self-structured, is very significant for the way a person deals with existing experiences and especially new ones. Self-orientation is a term used to denote prevalent orientations of the system in regulating the state of motivation. Participants of this study include 399 students from different faculties in Serbia (42.4% male and 57.6% female), between the ages of 18 and 36 years old. Aspiration index was used to evaluate motivation, and an Ego functioning questionnaire was used to evaluate self-orientation. Results show that intrinsic motivation is a better predictor of integrated self than extrinsic motivation. The results are similar when ego invested self is concerned, however, extrinsic motivation proved to be a better predictor. In predicting impersonal self both types of motivation proved to be significant predictors. In this model as well as in the first one intrinsic motivation is a better predictor than extrinsic motivation. The results are in accordance with the basic assumptions of the self-determination theory (Randelovic, & Todorovic, 2015).

2.2 Motivation Equation

Geelen and Soons (1996), provided an equation for motivation, which reads as, motivation equals (perceived chance of success x perceived importance of the goal) divided by (perceived cost x inclination to remain sedentary). This equation helps to battle obstacles of motivation using the four elements of the motivation equation: odds of success, importance of goal, costs, and inclination to remain sedentary.

Firstly, perceived chance of success, or self-efficacy is the strongest predictor of exercise in a majority of studies. There is a need for self-efficacy to motivate adults. Sources of influence of self-efficacy include successful performance of an activity, encouragement by a credible source, seeing like individuals perform, pain, fatigue, or anxiety (Resnick, 2007). In older adults, fear of falls, physical functioning, social decline, and survival are reasons for avoiding exercise. Also, importance of goals is very important in the motivation of individuals, and proper goals must be set. When setting goals, it is important to factor in the importance of health, and the definition of health (Phillips, Schneider, & Mercer, 2004). Often times, it is taught to take an "all or nothing approach," where it is thought that if someone cannot walk for one hour they obtain no health benefits. This is untrue, as it is important to develop an achievable, acceptable, graduated activity program for the best results. It has been shown that older persons may be more health-conscious than younger persons, and have been shown to increase their participation in physical activity at a faster rate than any other age group (Phillips et. al., 2004). Next, perceived cost encompasses a number of factors, which limit physical activity in adults. Perceived barriers, are powerful negative predictors of physical activity. As adults age, these barriers tend to increase, as availability of exercise partners, illness, and physical injury become greater concerns to these individuals. Access is also a contributing factor in perceived costs in adult physical activity. Factors that affect individual's commitment to physical activity include transportation, parking, location, ambiance, ventilation, lighting, refreshments, changing facilities, floor surfaces, and disability (Phillips, et. al., 2004). The final component of the motivation equation is the inclination to remain sedentary. Habits are a large component of the inclination to remain sedentary. Often times, adults, especially older adults, grew up with fewer influences on physical education, which promotes a more sedentary lifestyle later in life. For this reason, it is important to properly educate adults on the necessity of physical activity, and to continue to promote healthy exercise habits in young adults.

2.3 Seven Step Approach to Motivating Older Adults

Resnick (2007) offers a seven-step approach to motivating older adults. This approach can be used in a one on one setting, or in a group setting. The first step of this approach is education. During this step, it is important to provide education about benefits, risks of exercise, and ways to reduce risk. Reinforcement on both benefits and risks of the exercise is essential. The second step of this approach is screening. As a motivator, it is important to assure the individuals feel safe, and that the exercise program will benefit them. The third step of this approach is goal identification. Individuals must establish goals before any exercise is attempted, so that they know exactly what they need to do, and have something that the individual would like to achieve. The fourth step of this approach is eliminating barriers. Learning to anticipate and eliminate barriers is very important when following an exercise routine. The fifth step in this approach is having role models. Viewing others who have similar situations can motivate individuals to continue following the program effectively. The sixth step in this approach is verbal encouragement. Ongoing verbal encouragement reinforces the benefits of the program, and motivates the individual to keep trying. Finally, the seventh step in this approach reinforcement and rewards. It is important to keep the activity fun, challenging and different from what the individual is used to (Resnick, 2007).

2.4 Technology

Technology should not replace effective teaching, but it can be viewed as an effective supplement to appropriate pedagogical practices (Trout & Christie, 2007). Three decades after the invention of the calculator watch, wearable technology is considered to be a rapidly growing sector in the space of consumer electronics. Everything in today's society revolves around technology. With a growing number of our population struggling with obesity and subsequent health condition, there is a need to find alternative ways to combat this problem. Technology can provide a source of motivation for these individuals, and wearable technology in particular has become very popular. Through the ability to teach and coach participants, wearable technology can be an effective way to increase individual's activity levels. Technology is a major part of everyday life for most adults in today's society, and therefore has unlimited potential to improve the health and fitness aspect of individuals lives. As of 2021, 97% Americans own a cellphone of some kind. The number is up from 35% in Pew Research Center's first survey of smartphone ownership conducted in 2011 (Pew Research Center, 2021). However, with technology come barriers, as many individuals, particularly older adults, struggle with technology. Adult learners are characterized as having set habits and strong taste, a great deal of pride, a rational framework by which they make decisions, and have developed group behavior consistent with their needs (Chao, 2009). Therefore, implementing an exercise routine involving technology can be difficult in older adults because they are not as willing to learn about new technology. So, when designing wearable technology devices for an older population, they need to be easy to use, comfortable, and provide easy to understand data. Designers need to take this into account if they want to target an older population, and implement technology into their daily lives.

2.5 Use of Applications

The popularity of health and fitness apps is growing in society, which provide health educators an opportunity to incorporate these free to low cost resources into their plans. These technologies have the opportunity to connect to a very large population, which could not otherwise be reached. Through the use of smartphones, wearable technology, and apps, health educators can provide almost any information at the touch of button. Young adults are currently the most popular user of these resources, with the three most popular health and fitness apps being: exercise/fitness (38%), nutrition/calorie counter (31%), and weight loss apps (12%). The popularity and availability of health and fitness apps provides an opportunity for health educators to incorporate these free to low cost resources into programming (Gowin, Cheney, Gwin, &Wann, 2015).

The top five apps for increasing physical activity include Eat &Move O-Matic, Healthy Habits, IronKids, MotionMaze, Short Sequence: Kids' Yoga Journey (Martin, Coleman, Heinrichs, 2015). Firstly, Eat & Move O-Matic was designed to compare calories consumed to the time it takes to burn them off with varying types of physical activity. It offers a unique ability to see a relationship between what is being eaten, and what it takes to burn those calories consumed. Next, the Healthy Habits app helps youth maintain motivation over the first sixty days after initiating a change. Participants identify behaviors to modify, select achievement dates, send reminders, and track and share progress on social media platforms. The IronKids app teaches us to safely and effectively increase health and skill components of fitness to excel in physical activity. The app offers workouts, training pointers, and a custom workout function. The MotionMaze app is geared towards children, and is a puzzle app that requires physical movement to play. Children guide through maps as quickly as possible by walking or jogging in place and navigating through turns and obstacles in timed virtual mazes. Finally, Short Sequence: Kids' Yoga Journey is another children's app, which contains routines of seven yoga positions for children to follow.

A study named Apps of Steel was conducted in 2013. The objective of this study was to quantify the presence of health behavior theory constructs in iPhone apps targeting physical activity. This study searches how theory can improve interventions by identifying which theoretical constructs should be targeted and by determining fundamental behavior change techniques that should be incorporated (Cowan, Wagenen, Brown, Hedin, Stephan, Hall, & West, 2013). Smart phones have provided us with unlimited information, and resources to be more physically active, and motivate us. This study examines multiple apps and the details of them: the majority of apps (70%) were $1.99 or less, and most (89%) were not affiliated with a fitness organization. Almost half (47%) of the apps promoted a single exercise behavior, and 42% allowed users to post information to external sources. There is a lack of theoretical constructs in apps currently available, possibly due to lack of expertise in health behavior theory in designers. Instead, most designers have expertise in software development. This article relates to our research because it shows what current apps in Health & Fitness are providing, and can provide essential literature to my research questions. It also shows the difference between smartphone based applications, and wearable technology which we will be focusing on in our research. It could provide the benefits and disadvantages of wearable devices compared to applications.

2.6 Use of Applications

Access to mobile platforms and devices is not a problem in today's society, as almost every individual has access to them. About 80% of the world's population now has a mobile phone, and about one billion phones worldwide are smartphones (Mechelen, Mechelen, & Verhagen, 2013). Wearable technology was designed to address the majority of the population who are still inactive (Noah, Spierer, Gu, Bronner, 2013). These devices detect movement (accelerometers, and pedometers), and are a more convenient way to account for daily physical activity. They are often small, unobtrusive, and can be worn on the hip, wrist, or chest. Often times, they are used to measure intensity, duration, and frequency of steps, heart rate, and total volume of physical activity (Noah, et al., 2013). The most basic of devices are pedometers which count steps a person takes by detecting motion of the hands or hips (Bolyard, Adam, McDade, Sellers, Allen, Marshall, & Stover, 2015). However, many other, more advanced devices have been marketed in today's area of health and fitness. Some of these devices include the Moov multi-sport coach, Nike's Fitbit, the Apple Watch, and the Jawbone.

The Moov multi-sport wearable coach offers a variety of workouts, and coaching advice. The following workouts are included with the device: running/walking workouts, a cycling workout, a swimming workout, a full body anaerobic workout, and a cardio boxing workout. Each workout includes coaching from the device, which monitors data, gives feedback, and gives advice. Also, a third party heart rate monitor is available to be paired with the device, which can connect and compete with friends who have the device. With the most current model, a single device costs $79.99, and a pair of devices costs $159.99 (Moov Now, 2015). The pair is needed for the cardio boxing workout.

Fitbit offers a variety of devices including the Fitbit Charge, the Fitbit Charge HR, and the Fitbit Surge. Firstly, the Fitbit Charge has the ability to track steps, distance, calories burned, floors climbed, active minutes, and auto sleep. Alternatively to the Moov multi-sport wearable coach, the Fitbit devices track daily physical activity, while the Moov offers workouts, and feedback on those workouts. Next, the Fitbit Charge HR is one step up from the previous model, and adds the tracking of continuous heart rate throughout the day. Finally, the highest model is the Fitbit Surge. This model adds GPS tracking feature to the device. There are also a variety of models with fewer features than mentioned, and prices range from $49.99 to $199.99 (Fitbit, 2015).

"Fitness isn't just about running, biking, or hitting the gym. It's also about being active throughout the day. So Apple Watch measures all the ways you move, such as walking the dog, taking the stairs, or playing with your kids. It even keeps track of when individuals stand up and encourages individuals to keep moving. Because it all counts. And it all adds up (Apple, Inc., 2015)." The Apple Watch provides data total standing time throughout the day, time moved during the day, and total exercise time throughout the day. Also, for cardio workout, there is the ability to set goals, receive progress updates, and receive workout summaries. Additionally, the Apple Watch includes a heart rate monitor, accelerometer, and global positioning system (GPS), which all track data throughout the day.

The Jawbone wearable technology device is similar to the Fitbit, in that it tracks activity, steps, calories burned, and sleep each day. Additionally, this device includes a food-logging feature, which helps improve daily eating habits.

2.7 Use of Exergames

Exergames, or active games, are another form of technology. Exergames are a subtype of serious games designed for a primary purpose other than pure entertainment, but the user has to perform physical exercises to control the game (Hasselmann et al., 2015). These exergames must be task oriented and closely map real world activities, as well as provide instant feedback, social play, personalization, and persuasive technologies to be effective.

The top five active video games for the Xbox Kinect include Zumba Fitness Rush, Dance Central 3, Nike+ Kinect Training, UFC Personal Trainer, and EA Sports Active 2 (Martin et al., 2015). Zumba Fitness Rush features a large music database that encourages participants to enhance their fitness through dance. Dance Central 3 instructs players through dance moves from multiple decades including disco, hip-hop, and modern dance. Nike+ Kinect Training begins with an initial fitness assessment from which individualized exercise plans are developed. Participants are led through workouts similar to an exercise class in which instructors demonstrate and participants are coached. The UFC Personal Trainer teaches participants mixed martial arts and National Academy of Sports Medicine-approved exercises from wrestling, kickboxing, and Muay Thai. Finally, EA Sports Active 2 allows participants to create customizable workouts with combinations of games and activities and encourages user to commit to a progressive, nine-week body-composition program. Each of these exergames, or active games, offers a workout specified to a specific group of people, but all of them offer an exciting alternative to traditional workouts.

2.8 Wearable Technology and Eating Habits

Dietary self-monitoring is linked to improved weight loss success (Wharton, Johnston, Cunningham, & Sterner, 2014). Wearable technology and applications may allow for improved dietary tracking. Diet monitoring is compromised by reliance on accurate recall, lack of consistency of reporting, and the overall burden of data logging (Wharton et al., 2014). According to the American Heart Association (2015), a pedometer step count is much more accurate than physical activity self-reported in terms of predicting weight loss. This goes for tracking dietary habits as well. Self-reported data is often biased, and these apps provide a way to provide more accurate results, and improve habits in the future. To date, little research has documented the extent to which health-focused apps on smartphones are useful on smartphones are useful from the users' perspective or feasible in terms of self-monitoring of dietary intake (Wharton et al., 2014).

2.9 Wearable Technology and Sleep Patterns

Physical activity and sleep has a major impact on BMI, cardiovascular function, and salivary glutathione concentration. Increasing our exercise duration and frequency can result in excessive production of reactive oxygen and subsequent oxidation of reduced glutathione (GHS). Sleep deprivation can also induce oxidative stress, leading to increased GHS oxidation (Bolyard, Adams, McDade, Sellers, Allen, Marshall, & Stover, 2015).

In this study conducted by Bolyard, they incorporated the use of fitness trackers, with the help of biochemical and physiological assessments, to determine the effects of activity level and sleep quality on BMI, cardiovascular health, and Glutathione (GHS) concentration. A total of 9 males (ages 20 to 60) and 11 females (ages 21 to 59) participated. Based on three months of activity data obtained from bracelet embedded fitness tracking devices (Fitbit Flex), subjects were placed into 1 of 3 activity groups: a) minimum activity, b) moderate activity, and c) maximum activity. Participants in the minimum group (n=5) averaged fewer than 8,000 steps per day. Participants in the moderate group (n=9) averaged between 8,000 and 12,000 steps per day. Participants in the maximum group (n=6) averaged more than 12,000 steps per day. Participants were also placed into 1 of 3 sleep groups: a) minimum sleep, b) moderate sleep, and c) maximum sleep. Subjects in the minimum sleep group (n=4) slept less than 7 hours per day. Subjects in the moderate sleep group (n=12) slept between 7 and 8 hours per day. Subjects who were placed into the maximum sleep group (n=4) slept more than 8 hours per day.

The results of physical activity effects show that there were no significant differences between the 3 activity groups in terms of GSH concentration, systolic blood pressure (SBP), and diastolic blood pressure (DBP). BMI decreased with increasing activity, with the maximum activity group having a mean BMI significantly lower than that of the minimum activity group. HR also decreased with increasing activity. The maximum activity heart rate was significantly lower than the minimum activity heart rate. Within each group, there were no gender or age-related effects. The results of sleep effects show that there were no significant differences between the 3 sleep groups in terms of GSH concentration, BMI, HR, SBP, and DBP. Within each group, there were no gender or age related effects.

2.10 Importance of Physical Fitness

Maintaining physical fitness at all stages of life can be a difficult goal to achieve. Obesity in the United States continues to contribute to a number of serious health issues such as cardiovascular disease, stroke, diabetes, and even some cancers (Gowin et al., 2015). Inactivity is closely associated with chronic diseases and rising healthcare costs (Noah, et al., 2013). Therefore, it is important to provide a motivating tool for individuals of all ages, that promote healthy exercise habits, and contributes to a more physically active society. This task can be difficult, as different individuals have very different approaches to physical activity. Older adults for example, are less willing to use technology in their workouts, while a younger generation may be more willing to incorporate technology. For this reason, wearable technology devices must target the appropriate population depending on the features of that specific device. For example, an app, which offers high intensity exercise, may not be suitable for older adults, but could be very popular in younger adults. Nevertheless, physical activity is very important at all age ranges, and all individuals should be equally motivated to participate in physical activity.

2.11 Children

It is important to begin healthy physical activity routines at a young age. Wearable technology devices can help students learn both content related to statistics and about physical activities in general (Lee et al., 2015). A study was conducted by Utah University State University, on K-12 students, and how the devices could be used to help students learn both content related to statistics and about physical activity in general (Lee, et al., 2015). This study was designed to show that wearable technology devices could not only promote healthy exercise habits, but also teach children necessary content related to mathematics, which will promote their classroom learning. Also, active video games are appealing to children and adolescence, and they can increase intrinsic motivation towards fitness, as well as the percentage of time in free play, compared to more traditional forms of indoor physical activity (Gao, Hannon, Newton, Huang, 2011). With an alarming number of obese children, at 17% as of 2012, or 12.7 million children between the ages of two and nineteen years old, we need to address the problem of inactivity in children (CDC, 2015). At young ages, it is especially important to encourage healthy exercise habits, as these habits continue into adulthood. If a child is inactive at a young age, they will more than likely be inactive at older ages.

2.12 Young Adults

According to Gowin et al. (2015), obesity rates, in the United States, for young adults (18-25) are between 15% and 20%. A significant number of youth spend a large portion of their day being sedentary, accumulating, on average, to seven hours of screen time each day (Martin et al., 2015). This leads to poorer measures of body composition, decreased fitness, lower self-esteem, and reduced prosocial behavior (Tremblay, Leblanc, Kho, Saunders, & Larouche, 2011). As these young adults transition to adults, certain health behaviors are adopted, which lead to weight gain. It is estimated that college students gain between 4 and 9 pounds in the first year of college, and this weight gain compounds in the following year of college (Gowin et al., 2015). This generation of young adults are very technology savvy, and the Internet, social media, smartphones, etc. are very popular in this generation. For this reason, many wearable technology devices are being targeted towards them. Around 79% of young adults are likely to own a smartphone, and 24% of them use apps for tracking or managing their health (Gowin et al., 2015).

2.12 Older Adults

Aging is accompanied by a decline in mental function leading to a reduced motivation for physical fitness, which results in mobility impairment and a higher risk of falling (Hasselmann, Luque, & Bachmann, 2015). To combat this issue, an increase in physical activity and training can help maintain independence in daily living. The World Health Organization (WHO) recommends that adults over the age of 65 should practice aerobic exercise for at least 150 minutes of moderate intensity or 75 minutes of high intensity per week. Also, it is recommended to perform strengthening exercises at least twice per week and balance exercises at least three times per week. Often times with older adults, traditional physical activities are considered tedious and boring. Many older adults are not accustomed to regular physical activity programs for this reason, and it could be beneficial to implement a form of technology into the workout. However, the barrier would be a lack of knowledge with technology, and unwillingness to learn how to use the technology.

Hasselmann et al. (2015) conducted a study where he tried to increase older person's motivation for self-regulated exercises through the use of exergames. The primary aim of this research was to determine whether elderly persons in a rehabilitation setting show higher adherence to self-regulated training when using exergames than when performing conventional exercises. Also, an objective is to explore which mode of exercise leads to greater improvement in balance performance. Examples of exergames used in this study include The Kinect for Windows, and the Fitbit. The Kinect is a motion sensing input device by Microsoft for Xbox 360 video game consoles. It is made up of several video cameras and sensors specially adapted to track movements in a tri-dimensional space (Kinect for Windows). Also the Fitbit is considered an exergame (Hasselmann et al., 2015). The Fitbit has an integrated altimeter and tri-axial accelerometer that captures all daily activities. It tracks number of steps taken, stairs climbed, distance traveled, and calories burned every day (Fitbit One).

2.13 Conclusion

Through the use of technology, we are better able to motivate adults of all ages to increase their awareness about physical fitness, and the importance of regular physical fitness participation. Motivating adults to exercise can be a difficult task, but with advances in technology, educators are able to provide alternatives to traditional physical fitness methods. These new technologies include the development of mobile applications, wearable technology devices, and exergames. These devices have helped to track exercise habits, as well as eating habits, and sleeping habits. Many studies have been conducted on determining the reliability and validity of these devices, and developers have continued to expand their products to better meet the needs of users. The purpose of this study is to introduce adults to wearable technology devices, and examine their attitudes toward these devices. Attitude will be measured based on seven dimensions of attitude include comfort, efficacy, gender equality, control, dehumanization, interest, and utility.

3.Methods

3.1 Participants

Subjects were recruited through the James G. Mill Center for Health and Fitness at Indiana University of Pennsylvania (IUP). To participate in the study, participants had to be 18 years of age or older, and sign an informed consent form. Subjects were not excluded based on sex, ethnicity, income, or any other demographic factor. Inclusion criteria include any active member of the James G. Mill Center for Health and Fitness, or any individual over the age of 18, who is associated with the IUP, or surrounding community. Only current members of the fitness center were pursued. Only individuals under the age of 18, and with severe medical conditions, which prohibit physical activity, such as amputations, severe cardiovascular conditions, or other severe medical conditions, were excluded. Of the 34 participants that participated in this study, 50% (n = 17) were male and 50% (n = 17) were female. Furthermore, 52.94% (n = 18) were young adults (18-54 years old) and 47.05% (n = 16) were older adults (55 years old and older). A smartphone was required to use the wearable technology device. In order for participants without smartphones to not be excluded from the proposed study, an iPad was provided to the participant in order to take part in the study. This iPad remained in the researchers' possession, unless being used by the participant during the specified activity.

3.2 Recruitment

Participants were notified of the opportunity to participate in the study through regular passing by the front desk, in order not to pressure potential participant into volunteering. Participants included Indiana University of Pennsylvania students, faculty, and surrounding community members who are members of the fitness center. In order to recruit participants, flyers were placed around the James G. Mill Fitness Center, and Zink Hall. A flyer explaining the study, and risks of the study were handed out to members at the front desk by the researchers, and fitness center staff. Also, in order to advertise further, a memo pertaining information on the proposed study was provided in the James G. Mill Fitness Center March newsletter. This newsletter reaches all members signed up to receive it, who are members of the fitness center. All participants were required to sign the informed consent form before participating in the study, which thoroughly described the study, provided any benefits or potential harm, and the ability to withdraw from the study at any time. For any interested individuals, a sign-up sheet was placed at the front desk of the fitness center. Once signed up, the researchers provided informed consent forms, and the study was explained in further detail.

3.3 Instrumentation

In order to conduct this study, instruments were implemented for the use of the researchers and participants. Instruments include the Moov multi-sport wearable coach, a pre and post survey, a smartphone device/iPad, and treadmills in a safe fitness center setting.

The Moov multi-sport wearable coach offers a variety of features that work to coach its user, and provide effective training techniques for working out. The following provides some key feature of the Moov technology (Moov, 2015). The Moov multi-sport wearable coach has the ability to analyze and coach form, count repetitions for the user, and provide voice feedback as the user works out. These features are the backbone for twelve scientifically guided workout offered by the Moov. Workouts include daily activity tracking, a seven-minute total body workout, run and walk workouts, a cycling workout, sleep tracking, a cardio boxing workout, and a swimming workout. Additionally, the Moov device offers the ability to use a third party heart rate monitor, the ability to connect and compete with friends, a six month battery life, water and dust resistance, and an Omni motion 3D sensor. The Moov devices was kept by the researchers during the duration of the proposed study, and given to participants upon arrival to each activity. The educational session was provided before participants used the device so that they were familiar with how to use the Moov device. The data was collected during a two-week period where participants performed their own desired workout. This program was called the Run My Own Way: Open Training workout. Therefore, no specific workout instruction was needed, as participants were not given a set routine workout to follow.

A pre and post survey was distributed before and after the distribution of the Moov Multi-Sport Wearable Coach. Both surveys are identical and used to identify a change in attitudes toward these devices. For this proposed study, The Attitudes Toward Computers Questionnaire (ATCQ) was used, as well as a simple background information survey, which asked about gender, age, and current computer knowledge. The ATCQ is a multi-dimensional measure assessing seven dimensions of attitudes toward computers identified in prior research on students and adults: comfort, efficacy, gender equality, control, dehumanization, interest, and utility (Jay & Willis, 1992). The comfort dimension assesses the feeling of comfort toward computers. Efficacy shows the participants feeling of competence towards computers. Gender equality refers to the belief that computers are important to both men and women. Control refers to the belief that people control computers. Interest refers to the participant's interest in learning about computers. Dehumanization refers to computers being dehumanizing. Finally, utility refers to the idea that computers are useful. The seven dimensions of attitude are assessed by five or six survey questions based on a 5-point Likert scale format, with responses ranging from strongly disagree (5) to strongly agree (1).

Other instruments used during this study included treadmills, and smartphones/iPad's. In order to use the Moov device, the participant required access to a smartphone, or iPad. Therefore, participants with access to a smartphone used it to take part in the study. Otherwise, an iPad was provided in a case where no smartphone is assessable to the participant. In order for the Moov devices to be used, the app was downloaded to the user's smartphone, and already downloaded to the designated iPad for the study.

3.4 Procedures

At the start of the study, after receiving informed consent, participants were provided with an educational session to show them how to utilize the Moov Multi-Sport Wearable Coach, and how to utilize it during their workout. Following this educational session, participants were required to complete the pre ATCQ questionnaire, and the background survey. The background survey gathered information about participant's gender, age, and current computer knowledge. The ATCQ Questionnaire asked 35 questions pertaining directly to the 7 dimensions of attitude change. The Moov devices were kept by the researchers during the duration of the study, and given to participants upon arrival to each activity. Each week, during the two-week period, participant performed their normal treadmill workouts, and utilized the Moov device during this workout. After each exercise session, participants were required to log total time of workout, distance traveled, total steps, cadence (steps/minute), average range of motion, and average impact score. The study took place over two-2 week periods, with each week consisting of the same, Run My Own Way workout. This workout allows users to perform own cardio workout on the treadmill, at their own pace, and duration. Therefore, the researchers did not implement any exercise routine for participants. Following the two-week workout period, participants were given the post ATCQ Questionnaire to complete. This questionnaire was identical to the pre questionnaire, and was used to analyze a difference in scores. For the safety of the participants, activity was only allowed during fitness center hours. As a result, a staff member trained in CPR and First Aid was available at all times. Each participant received a folder, which was used to keep the participants log sheets, and surveys secure. These folders were kept locked in the fitness center at all times. Upon completion of the study, surveys were gathered, and results were submitted into the researchers' computer to be analyzed, using SPSS software. Data remains in the researchers' computer, and not be available to any outside party.

3.5 Research Design

This study utilized survey research methodologies. Survey research is a type of quantitative, descriptive research where the researchers select a sample of respondents from a population and administers a standardized questionnaire to them. (Survey Research, 2015). This survey gathered data on the seven dimensions of attitude in participants utilizing the Moov Multi-Sport Wearable Coach.

Survey methods in the form of a pre and post typed questionnaire completed in person were used in this study to identify the change in attitudes toward wearable devices from before and after the use of a wearable technology device. The Moov multi-sport wearable coach was distributed in between the pre and post survey for a two-week period. Participants performed their normal cardio routine during the two-week period that they used the Moov device.

3.6 Statistical Analysis

In order to analyze data, the researchers utilized *t*-tests, and descriptive discriminant function analysis. For the first research question, paired sample *t*-tests were run to see if wearable technology devices have an effect on participant's attitudes toward physical activity. Paired sample *t*-test is a statistical technique that is used to compare two population means in the case of two samples that are correlated. They are used in "before-after" studies, exactly how this study is being conducted. In this study, paired sample *t*-test was utilized through a pre and post survey, to see if wearable technology has an effect on participant's attitude. Additionally, independent sample *t*-test was used to determine if there is a significant difference in male versus female attitudes, and young adults versus older adult's attitudes toward wearable technology. Independent sample t-tests assess if differences exist on a continuous dependent variable (attitudes) by a dichotomous (two groups) independent variable (male/female; young adult/older adult). The *t*-test was two-tailed, with alpha levels, or the probability of rejecting the null hypothesis when it is true, set at $p < 0.05$. This ensures a 95% certainty that the relationships did not occur by chance. Finally, descriptive discriminant function analysis was used to determine the number of attitude dimensions (discriminant functions) that maximize the differences among the groups. It also shows patterns in the scales that differ between two groups and puts a coefficient on the predictive variables (seven categories) in order to rank them based on the participant's perception. Simple, discriminant function analysis is classification (distribution into groups, classes or categories of the same type).

4.Results

4.1 Demographic Information

Of the 34 participants that participated in this study, 50% (n = 17) were male and 50% (n = 17) were female. Furthermore, 52.94% (n = 18) were young adults (18-54 years old) and 47.05% (n = 16) were older adults (55 years old and older).

4.2 Wearable Technology Effect on Participants Attitudes Toward Exercise

To answer the first research question, paired sample *t*-test and independent sample *t*-tests were run (Table 1)

4.3 Entire Population

Table 1 *Paired Samples Statistics for Entire Population*

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Overall Score	3.1193	34	.26871	.04608
	Post Overall Score	3.1790	34	.30191	.05178
Pair 2	Pre Comfort	3.5471	34	.47048	.08069
	Post Comfort	3.5118	34	.62511	.10721
Pair 3	Pre Efficacy	1.7294	34	.50903	.08730
	Post Efficacy	1.7941	34	.53595	.09191
Pair 4	Pre Gender Equality	3.6529	34	.52871	.09067
	Post Gender Equality	3.6765	34	.53714	.09212
Pair 5	Pre Control	2.6059	34	.48862	.08380
	Post Control	2.6000	34	.45660	.07831
Pair 6	Pre Dehumanization	3.5049	34	.79824	.13690
	Post Dehumanization	3.6961	34	.82212	.14099
Pair 7	Pre Interest	2.9765	34	.41125	.07053
	Post Interest	3.0353	34	.33564	.05756
Pair 8	Pre Utility	3.6275	34	.49247	.08446
	Post Utility	3.7500	34	.48591	.08333

A paired samples *t*-test was calculated to compare the pretest mean scores of each of the dimensions of attitude toward computers to the posttest mean scores of the dimensions of attitude toward computers. As shown in table 1, the mean pre overall score was 3.12 (*sd* = .27), the mean post overall score was 3.18 (*sd* = .30), the mean pre comfort score was 3.44 (*sd* = .47), the mean post comfort score was 3.52 (*sd* = .63), the mean pre efficacy score was 1.73 (*sd* = .51), the mean post efficacy score was 1.79 (*sd* = .54), the mean pre gender equality score was 3.65 (*sd* = .53), the mean post gender equality score was 3.68 (*sd* = .54), the mean pre control score was 2.61 (*sd* = .49), the mean post control score was 2.6 (*sd* = .46), the mean pre dehumanization score was 3.51 (*sd* = .80), the mean post dehumanization score was 3.70 (*sd* = .82), the mean pre interest score was 2.98 (*sd* = .41), the mean post interest score was 3.04 (*sd* = .34), the mean pre utility score was 3.63 (*sd* = .49), and the mean post utility score was 3.75 (*sd* = .49).

Table 2 *Paired Samples t-test for the Entire Population*

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre Overall Score - Post Overall Score	-.05966	.18760	.03217	-.12512	.00579	-1.854	33	.073
Pair 2	Pre Comfort - Post Comfort	.03529	.39534	.06780	-.10265	.17323	.521	33	.606
Pair 3	Pre Efficacy - Post Efficacy	-.06471	.32182	.05519	-.17699	.04758	-1.172	33	.249
Pair 4	Pre Gender Equality - Post Gender Equality	-.02353	.41419	.07103	-.16805	.12099	-.331	33	.743
Pair 5	Pre Control - Post Control	.00588	.37654	.06458	-.12550	.13726	.091	33	.928
Pair 6	Pre Dehumanization - Post Dehumanization	-.19118	.42666	.07317	-.34005	-.04231	-2.613	33	.013
Pair 7	Pre Interest - Post Interest	-.05882	.46064	.07900	-.21955	.10190	-.745	33	.462
Pair 8	Pre Utility - Post Utility	-.12255	.40888	.07012	-.26522	.02012	-1.748	33	.090

As shown in table 2, no significant effect was found on the overall attitude toward computers score from pretest to posttest was found ($t(33) = 1.854$, $p > .05$). No significant effect was found on the dimension of comfort from pretest to posttest was found ($t(33) = .521$, $p > .05$). No significant effect was found on the dimension of efficacy from pretest to posttest was found ($t(33) = 1.172$, $p > .05$). No significant effect was found on the dimension of gender equality from pretest to posttest was found ($t(33) = -.331$, $p > .05$). No significant effect was found on the dimension of control from pretest to posttest was found ($t(33) = .091$, $p > .05$). A significant increase on the dimension of dehumanization from pretest to posttest was found ($t(33) = 2.613$, $p < .05$). Therefore, participants found wearable technology less dehumanizing after using a device for a two week period. No significant effect was found on the dimension of interest from pretest to posttest was found ($t(33) = -.745$, $p > .05$). No significant effect was found on the dimension of utility from pretest to posttest was found ($t(33) = 1.748$, $p > .05$).

4.4 Young Adults vs. Older Adults

An independent sample t-test was conducted to determine if there is a significant difference in the dimensions of attitude among young adults and older adults.

Table 3 *Group Statistics for Young Adults vs. Older Adults*

	Age Group	N	Mean	Std. Deviation	Std. Error Mean
Post minus Pre scores	Young	18	.1111	.22216	.05236
	Old	16	.0018	.12143	.03036
Overall S1	Young	18	.0667	.32899	.07754
	Old	16	-.1500	.44121	.11030
Overall S2	Young	18	.1111	.24944	.05879
	Old	16	.0125	.38966	.09741
Overall S3	Young	18	.1000	.33077	.07796
	Old	16	-.0625	.48836	.12209
Overall S4	Young	18	.0667	.42288	.09967
	Old	16	-.0875	.30957	.07739
Overall S5	Young	18	.2315	.52437	.12360
	Old	16	.1458	.29107	.07277
Overall S6	Young	18	.1222	.59067	.13922
	Old	16	-.0125	.24732	.06183
Overall S7	Young	18	.1111	.39606	.09335
	Old	16	.1354	.43554	.10889

Table 4 *Independent Samples Test for Young Adults vs. Older Adults*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post minus Pre scores	Equal variances assumed	1.609	.214	1.748	32	.090	.10933	.06254	-.01806	.23671
	Equal variances not assumed			1.806	26.904	.082	.10933	.06053	-.01488	.23354

Overall S1	Equal variances assumed	.985	.328	1.635	32	.112	.21667	.13252	-.05326	.48660
	Equal variances not assumed			1.607	27.552	.119	.21667	.13483	-.05973	.49306
Overall S2	Equal variances assumed	.450	.507	.889	32	.381	.09861	.11093	-.12734	.32456
	Equal variances not assumed			.867	24.992	.394	.09861	.11378	-.13573	.33295
Overall S3	Equal variances assumed	4.911	.034	1.147	32	.260	.16250	.14163	-.12600	.45100
	Equal variances not assumed			1.122	25.924	.272	.16250	.14486	-.13531	.46031
Overall S4	Equal variances assumed	.558	.461	1.200	32	.239	.15417	.12852	-.10763	.41596
	Equal variances not assumed			1.222	30.934	.231	.15417	.12619	-.10322	.41156
Overall S5	Equal variances assumed	.760	.390	.578	32	.567	.08565	.14810	-.21602	.38732
	Equal variances not assumed			.597	27.133	.555	.08565	.14343	-.20857	.37987
Overall S6	Equal variances assumed	2.998	.093	.848	32	.403	.13472	.15895	-.18906	.45850
	Equal variances not assumed			.884	23.338	.386	.13472	.15233	-.18015	.44960
Overall S7	Equal variances assumed	.806	.376	-.170	32	.866	-.02431	.14260	-.31478	.26617
	Equal variances not assumed			-.169	30.578	.867	-.02431	.14343	-.31699	.26838

As shown in table 3 and table 4, an independent-samples *t*-test was calculated comparing the mean scores of each of the dimensions of attitude between younger adults and older adults. No significant difference was found in overall post minus pre scores ($t(33) = 1.748$, $p > .05$). The mean of the younger adults ($M = .1111$, $sd = .22$) was not significantly different from the mean of the older adults ($M = .0018$,$sd = .12$) No significant difference was found in the dimension of comfort (S1) ($t(33) = 1.635$, $p > .05$). The mean of the younger adults ($M = .0667$, $sd = .33$) was not significantly different from the mean of the older adults ($M = -.1500$, $sd = .44$) in regards to the dimension of comfort. No significant difference was found in the dimension of efficacy (S2) ($t(33) = 0.880$, $p > .05$). The mean of the younger adults ($M = .1111$, $sd = .25$) was not significantly different from the mean of the older adults ($M = .0125$, $sd = .39$) in regards to the dimension of efficacy. No significant difference was found in the dimension of gender equality (S3) ($t(33) = 1.122$, $p > .05$). The mean of the younger adults ($M = .1000$, $sd = .33$) was not significantly different from the mean of the older adults ($M = -.0625$, $sd = .49$) in regards to the dimension of gender equality. No significant difference was found in the dimension of control (S4) ($t(33) = 1.200$, $p > .05$). The mean of the younger adults ($M = .0667$, $sd = .42$) was not significantly different from the mean of the older adults ($M = -.0875$, $sd = .31$) in regards to the dimension of control. No significant difference was found in the dimension of dehumanization (S5) ($t(33) = .578$, $p > .05$). The mean of the younger adults ($M = .2315$, $sd = .52$) was not significantly different from the mean of the older adults ($M = .1458$, $sd = .29$) in regards to the dimension of dehumanization. No significant difference was found in the dimension of interest (S6) ($t(33) = 0.848$, $p > .05$). The mean of the younger adults ($M = .1222$, $sd = .59$) was not significantly different from the mean of the older adults ($M = -.0125$, $sd = .25$) in regards to the dimension of interest. No significant difference was found in the dimension of utility (S7) ($t(33) = -.0170$, $p > .05$). The mean of the younger adults ($M = .1111$, $sd = .40$) was not significantly different from the mean of the older adults ($M = .1354$, $sd = .44$) in regards to the dimension of utility

4.5 Men vs. Females

An independent sample *t*-test was conducted to determine if there is a significant difference in the dimensions of attitude among men and females.

Table 5 *Group Statistics for Men vs. Females*

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Post minus Pre scores	Male	17	.0756	.21522	.05220
	Female	17	.0437	.16039	.03890
Overall S1	Male	17	-.0353	.43724	.10605
	Female	17	-.0353	.36218	.08784
Overall S2	Male	17	.0471	.28748	.06973
	Female	17	.0824	.36096	.08755
Overall S3	Male	17	.0588	.48355	.11728
	Female	17	-.0118	.34257	.08308
Overall S4	Male	17	.0588	.38578	.09356
	Female	17	-.0706	.36702	.08902
Overall S5	Male	17	.1569	.27933	.06775
	Female	17	.2255	.54308	.13172
Overall S6	Male	17	.0588	.35189	.08534
	Female	17	.0588	.56020	.13587
Overall S7	Male	17	.1961	.46486	.11275
	Female	17	.0490	.34240	.08304

Table 6 *Independent Samples Test for Men vs. Females*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post minus Pre scores	Equal variances assumed	.238	.629	.491	32	.627	.03193	.06510	-.10067	.16454
	Equal variances not assumed			.491	29.583	.627	.03193	.06510	-.10110	.16496

Overall S1	Equal variances assumed	.787	.382	.000	32	1.000	.00000	.13770	-.28049	.28049
	Equal variances not assumed			.000	30.928	1.000	.00000	.13770	-.28087	.28087
Overall S2	Equal variances assumed	.615	.439	-.315	32	.755	-.03529	.11192	-.26327	.19268
	Equal variances not assumed			-.315	30.474	.755	-.03529	.11192	-.26371	.19313
Overall S3	Equal variances assumed	.712	.405	.491	32	.627	.07059	.14373	-.22217	.36335
	Equal variances not assumed			.491	28.829	.627	.07059	.14373	-.22344	.36462
Overall S4	Equal variances assumed	.014	.906	1.002	32	.324	.12941	.12914	-.13365	.39247
	Equal variances not assumed			1.002	31.921	.324	.12941	.12914	-.13367	.39250
Overall S5	Equal variances assumed	2.232	.145	-.463	32	.646	-.06863	.14812	-.37033	.23308
	Equal variances not assumed			-.463	23.912	.647	-.06863	.14812	-.37439	.23713
Overall S6	Equal variances assumed	.626	.435	.000	32	1.000	.00000	.16045	-.32682	.32682
	Equal variances not assumed			.000	26.925	1.000	.00000	.16045	-.32926	.32926
Overall S7	Equal variances assumed	.754	.392	1.050	32	.301	.14706	.14003	-.13817	.43229
	Equal variances not assumed			1.050	29.413	.302	.14706	.14003	-.13916	.43327

An independent-samples *t*-test was calculated comparing the mean scores of each of the dimensions of attitude between males and females. As shown in table 5 and table 6, no significant difference was found in overall posttest minus pretest scores ($t(33) = .491$, $p > .05$).

The mean of the younger adults ($M = .0756$, $sd = .22$) was not significantly different from the mean of the older adults ($M = .043$, $sd = .16$) in regards to the overall posttest minus pretest scores. No significant difference was found in the dimension of comfort (S1) ($t(33) = .00$, $p > .05$). The mean of the males ($M = -.0353$, $sd = .44$) was not significantly different from the mean of the females ($M = -.0353$, $sd = .36$) in regards to the dimension of comfort. No significant difference was found in the dimension of efficacy (S2) ($t(33) = -.315$, $p > .05$). The mean of the males ($M = .0471$, $sd = .29$) was not significantly different from the mean of the females ($M = .0824$, $sd = .36$) in regards to the dimension of efficacy. No significant difference was found in the dimension of gender equality (S3) ($t(33) = .491$, $p > .05$). The mean of the males ($M = .0588$, $sd = .48$) was not significantly different from the mean of the females ($M = -.0118$, $sd = .34$) in regards to the dimension of gender equality. No significant difference was found in the dimension of control (S4) ($t(33) = 1.002$, $p > .05$). The mean of the males ($M = .0588$, $sd = .39$) was not significantly different from the mean of the females ($M = -.0706$, $sd = .37$) in regards to the dimension of control. No significant difference was found in the dimension of dehumanization (S5) ($t(33) = -.463$, $p > .05$). The mean of the males ($M = .1569$, $sd = .28$) was not significantly different from the mean of the females ($M = .2255$, $sd = .54$) in regards to the dimension of dehumanization. No significant difference was found in the dimension of interest (S6) ($t(33) = 0.00$, $p > .05$). The mean of the males ($M = .0588$, $sd = .35$) was not significantly different from the mean of the females ($M = .0588$, $sd = .56$) in regards to the dimension of interest. No significant difference was found in the dimension of utility (S7) ($t(33) = 1.050$, $p > .05$). The mean of the males ($M = .1961$, $sd = .46$) was not significantly different from the mean of the females ($M = .0490$, $sd = .34$) in regards to the dimension of utility.

4.6 Any Significant Differences in the Seven Dimensions of Attitude Change Between Participants

Descriptive discriminant function analysis was run to determine if there are patterns in the scales that differ between young adults/older adults, and men/females in regards to the seven dimensions of attitude.

4.7 Regression

A regression was run to check for multivariate outliers before the discriminant analysis could be run. When the command is run, the Mahal. Distance in table 8, must be less than 24.32. If outliers are found, the Explore command is run in SPSS software, which identifies the outliers. For this study, two outliers were found, which were removed from the data set before running the discriminant.

Table 7 *Coefficients of Regression*

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-1.573	38.966		-.040	.968
	Pre Comfort	3.941	9.105	.180	.433	.671
	Pre Efficacy	4.253	6.142	.210	.692	.498
	Pre Gender Equality	7.124	5.913	.371	1.205	.245
	Pre Control	-16.091	7.959	-.753	-2.022	.059
	Pre Dehumanization	-13.288	7.618	-.910	-1.744	.099
	Pre Interest	4.417	9.156	.153	.482	.636
	Pre Utility	15.471	9.006	.746	1.718	.104
	Post Comfort	12.827	8.114	.790	1.581	.132
	Post Efficacy	-.197	6.375	-.010	-.031	.976
	Post Gender Equality	-2.791	6.056	-.148	-.461	.651
	Post Control	19.111	6.114	.877	3.126	.006
	Post Dehumanization	7.361	8.183	.561	.900	.381
	Post Interest	-26.408	11.328	-.824	-2.331	.032
	Post Utility	-10.108	7.473	-.465	-1.353	.194

a. Dependent Variable: Case Number

Table 8 *Residual Statistics of Regression*

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.03	36.65	17.59	8.209	32
Std. Predicted Value	-1.652	2.322	.000	1.000	32
Standard Error of Predicted Value	4.389	7.471	5.647	.757	32
Adjusted Predicted Value	.36	51.88	16.90	10.410	32
Residual	-14.131	11.877	.000	6.161	32
Std. Residual	-1.699	1.428	.000	.741	32
Stud. Residual	-1.999	1.996	.034	.977	32
Deleted Residual	-19.580	23.217	.690	11.177	32
Stud. Deleted Residual	-2.218	2.213	.021	1.023	32
Mahal. Distance	7.658	24.035	13.563	3.879	32
Cook's Distance	.000	.277	.055	.069	32
Centered Leverage Value	.247	.775	.438	.125	32

a. Dependent Variable: Case Number

4.8 Discriminant (Age: pre)

A discriminant function analysis was conducted to determine whether seven variables – comfort, efficacy, gender equality, control, dehumanization, interest, and utility - could predict the groups of young adults and older adults who were introduced to wearable technology through the pretest. Prior to analysis, two outliers were eliminated. Group covariance's are equal, and therefore, do not limit interpretation. According to table 10, one function was generated and was significant (Λ = .807, X^2 (30, n = 32) = 7.169, p < .05), indicating that younger adults provided significantly lower efficacy score than older adults. Finally, table 14 illustrates the structure matrix, which ranks dimensions based on correlation coefficients. These coefficients show what dimensions impact the two age groups (younger adults/older adults) the most. Pre efficacy impacts the two age groups the most, and is the only significant functio.

Table 9 *Group Statistics for Age Pretest Questions*

				Valid N (listwise)	
Age Group		Mean	Std. Deviation	Unweighted	Weighted
Young	Pre Comfort	3.5875	.51881	16	16.000
	Pre Efficacy	1.5250	.48374	16	16.000
	Pre Gender Equality	3.7625	.52265	16	16.000
	Pre Control	2.6875	.50580	16	16.000
	Pre Dehumanization	3.6979	.80788	16	16.000
	Pre Interest	2.8500	.40332	16	16.000
	Pre Utility	3.7500	.41722	16	16.000
Old	Pre Comfort	3.4750	.42505	16	16.000
	Pre Efficacy	1.9625	.43951	16	16.000
	Pre Gender Equality	3.5250	.53603	16	16.000
	Pre Control	2.5875	.46458	16	16.000
	Pre Dehumanization	3.5104	.59151	16	16.000
	Pre Interest	3.0500	.27809	16	16.000
	Pre Utility	3.5417	.55611	16	16.000
Total	Pre Comfort	3.5313	.47003	32	32.000
	Pre Efficacy	1.7438	.50605	32	32.000
	Pre Gender Equality	3.6438	.53457	32	32.000
	Pre Control	2.6375	.48042	32	32.000
	Pre Dehumanization	3.6042	.70298	32	32.000
	Pre Interest	2.9500	.35560	32	32.000
	Pre Utility	3.6458	.49505	32	32.000

Table 10 *Tests of Equality of Group Means for Age Pretest Questions*

	Wilks' Lambda	F	df1	df2	Sig.
Pre Comfort	.985	.450	1	30	.507
Pre Efficacy	.807	7.169	1	30	.012
Pre Gender Equality	.949	1.610	1	30	.214
Pre Control	.989	.339	1	30	.565
Pre Dehumanization	.982	.561	1	30	.460
Pre Interest	.918	2.667	1	30	.113
Pre Utility	.954	1.437	1	30	.240

Table 11 *Test Results for Age Pretest Questions*

Box's M		29.717
F	Approx.	.791
	df1	28
	df2	3136.116
	Sig.	.774

Tests null hypothesis of equal population covariance matrices.

Table 12 *Eigenvalues for Age Pretest Questions*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.967[a]	100.0	100.0	.701

a. First 1 canonical discriminant functions were used in the analysis.

Table 13 *Wilks'Lambda for Age Pretest Questions*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.508	17.934	7	.012

Table 14 *Structure Matrix for Age Pretest Questions*

	Function
	1
Pre Efficacy	.497
Pre Interest	.303
Pre Gender Equality	-.236
Pre Utility	-.222
Pre Dehumanization	-.139
Pre Comfort	-.125
Pre Control	-.108

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

Table 15 *Classification Results for Age Pretest Questions*

			Predicted Group Membership		
		Age Group	Young	Old	Total
Original	Count	Young	14	2	16
		Old	5	11	16
	%	Young	87.5	12.5	100.0
		Old	31.3	68.8	100.0
Cross-validated[b]	Count	Young	10	6	16
		Old	5	11	16
	%	Young	62.5	37.5	100.0
		Old	31.3	68.8	100.0

a. 78.1% of original grouped cases correctly classified.

b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

c. 65.6% of cross-validated grouped cases correctly classified.

4.9 Discriminant (Age: post)

A discriminant function analysis was conducted to determine whether seven variables – comfort, efficacy, gender equality, control, dehumanization, interest, and utility - could predict the groups of young adults and older adults who were introduced to wearable technology through the posttest. Prior to analysis, two outliers were eliminated. Group covariance's are equal, and therefore, do not limit interpretation According to table 17, one function was generated and was significant ($\Lambda = .861$, X^2 (30, $n = 32$) = 4.827, $p < .05$), indicating that younger adults gender equality scores were significantly higher than older adults. Finally, table 21 illustrates the structure matrix, which ranks dimensions based on correlation coefficients. These coefficients show what dimensions impact the two age groups (younger adults/older adults) the most. While there are no significant results, gender equality is shown to be the highest ranked function in the structure matrix.

Table 16 *Group Statistics for Age Posttest Questions*

Age Group		Mean	Std. Deviation	Valid N (listwise) Unweighted	Valid N (listwise) Weighted
Young	Post Comfort	3.6625	.65205	16	16.000
	Post Efficacy	1.6500	.48166	16	16.000
	Post Gender Equality	3.8625	.53025	16	16.000
	Post Control	2.7000	.51121	16	16.000
	Post Dehumanization	3.8021	.87394	16	16.000
	Post Interest	3.0500	.38297	16	16.000
	Post Utility	3.8854	.42912	16	16.000
Old	Post Comfort	3.3250	.58367	16	16.000
	Post Efficacy	1.9750	.54589	16	16.000
	Post Gender Equality	3.4625	.49917	16	16.000
	Post Control	2.5000	.41952	16	16.000
	Post Dehumanization	3.6563	.70045	16	16.000
	Post Interest	3.0375	.25528	16	16.000
	Post Utility	3.6771	.50358	16	16.000
Total	Post Comfort	3.4938	.63242	32	32.000
	Post Efficacy	1.8125	.53264	32	32.000
	Post Gender Equality	3.6625	.54581	32	32.000
	Post Control	2.6000	.47110	32	32.000
	Post Dehumanization	3.7292	.78260	32	32.000
	Post Interest	3.0437	.32022	32	32.000
	Post Utility	3.7813	.47224	32	32.000

Table 17 *Tests of Equality of Group Means for Age Posttest Questions*

	Wilks' Lambda	F	df1	df2	Sig.
Post Comfort	.927	2.380	1	30	.133
Post Efficacy	.904	3.189	1	30	.084
Post Gender Equality	.861	4.827	1	30	.036
Post Control	.953	1.463	1	30	.236
Post Dehumanization	.991	.271	1	30	.606
Post Interest	1.000	.012	1	30	.914
Post Utility	.950	1.586	1	30	.218

Table 18 *Test Results for Age Posttest Questions*

Box's M		35.066
F	Approx.	.933
	df1	28
	df2	3136.116
	Sig.	.566

Tests null hypothesis of equal population covariance matrices.

Table 19 *Eigenvalues for Age Posttest Questions*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.437[a]	100.0	100.0	.552

a. First 1 canonical discriminant functions were used in the analysis.

Table 20 *Wilks'Lambda for Age Posttest Questions*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.696	9.613	7	.212

Table 21 *Structure Matrix for Age Posttest Questions*

	Function 1
Post Gender Equality	-.607
Post Efficacy	.493
Post Comfort	-.426
Post Utility	-.348
Post Control	-.334
Post Dehumanization	-.144
Post Interest	-.030

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

Table 22 *Classification Results for Age Posttest Questions*

			Predicted Group Membership		
		Age Group	Young	Old	Total
Original	Count	Young	13	3	16
		Old	6	10	16
	%	Young	81.3	18.8	100.0
		Old	37.5	62.5	100.0
Cross-validated[b]	Count	Young	8	8	16
		Old	7	9	16
	%	Young	50.0	50.0	100.0
		Old	43.8	56.3	100.0

a. 71.9% of original grouped cases correctly classified.

b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

c. 53.1% of cross-validated grouped cases correctly classified.

4.10 Discriminant (Gender: pre)

A discriminant function analysis was conducted to determine whether seven variables – comfort, efficacy, gender equality, control, dehumanization, interest, and utility - could predict the groups of males and females who were introduced to wearable technology through the pretest. Prior to analysis, two outliers were eliminated. According to table 24, no functions in the discriminant analysis were significant, indicating that the seven dimensions of cannot predict whether someone is young or old based on their responses to the questions in the posttest. Finally, table 28 illustrates the structure matrix, which ranks dimensions based on correlation coefficients. These coefficients show what dimensions impact the two age groups (younger adults/older adults) the most. While there are no significant results, dehumanization is shown to be the highest ranked function in the structure matrix.

Table 23 *Group Statistics for Age Pretest Questions*

				Valid N (listwise)	
Gender		Mean	Std. Deviation	Unweighted	Weighted
Male	Pre Comfort	3.6000	.45277	17	17.000
	Pre Efficacy	1.7176	.53413	17	17.000
	Pre Gender Equality	3.6235	.61596	17	17.000
	Pre Control	2.6000	.52915	17	17.000
	Pre Dehumanization	3.7941	.74192	17	17.000
	Pre Interest	3.0353	.40765	17	17.000
	Pre Utility	3.6569	.42275	17	17.000

Female	Pre Comfort	3.4533	.49261	15	15.000
	Pre Efficacy	1.7733	.48912	15	15.000
	Pre Gender Equality	3.6667	.44508	15	15.000
	Pre Control	2.6800	.43293	15	15.000
	Pre Dehumanization	3.3889	.60967	15	15.000
	Pre Interest	2.8533	.26690	15	15.000
	Pre Utility	3.6333	.58146	15	15.000
Total	Pre Comfort	3.5313	.47003	32	32.000
	Pre Efficacy	1.7438	.50605	32	32.000
	Pre Gender Equality	3.6438	.53457	32	32.000
	Pre Control	2.6375	.48042	32	32.000
	Pre Dehumanization	3.6042	.70298	32	32.000
	Pre Interest	2.9500	.35560	32	32.000
	Pre Utility	3.6458	.49505	32	32.000

Table 24 *Tests of Equality of Group Means for Gender Pretest Questions*

	Wilks' Lambda	F	df1	df2	Sig.
Pre Comfort	.975	.770	1	30	.387
Pre Efficacy	.997	.094	1	30	.762
Pre Gender Equality	.998	.050	1	30	.824
Pre Control	.993	.215	1	30	.646
Pre Dehumanization	.915	2.802	1	30	.105
Pre Interest	.933	2.165	1	30	.152
Pre Utility	.999	.017	1	30	.896

Table 25 *Tests Results for Gender Pretest Questions*

Box's M		31.616
F	Approx.	.839
	df1	28
	df2	3024.500
	Sig.	.707

Tests null hypothesis of equal population covariance matrices.

Table 26 *Eigenvalues for Gender Pretest Questions*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.216[a]	100.0	100.0	.421

a. First 1 canonical discriminant functions were used in the analysis.

Table 27 *Wilks'Lambda for Gender Pretest Questions*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.823	5.174	7	.639

Table 28 *Structure Matrix for Gender Pretest Questions*

	Function
	1
Pre Dehumanization	.658
Pre Interest	.579
Pre Comfort	.345
Pre Control	-.182
Pre Efficacy	-.120
Pre Gender Equality	-.088
Pre Utility	.052

Table 29 *Classification Results for Gender Pretest Questions*

			Predicted Group Membership		
		Gender	Male	Female	Total
Original	Count	Male	10	7	17
		Female	4	11	15
	%	Male	58.8	41.2	100.0
		Female	26.7	73.3	100.0
Cross-validated[b]	Count	Male	9	8	17
		Female	9	6	15
	%	Male	52.9	47.1	100.0
		Female	60.0	40.0	100.0

a. 65.6% of original grouped cases correctly classified.

b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

c. 46.9% of cross-validated grouped cases correctly classified.

4.11 Discriminant (Gender: post)

A discriminant function analysis was conducted to determine whether seven variables – comfort, efficacy, gender equality, control, dehumanization, interest, and utility - could predict the groups of males and females who were introduced to wearable technology through the posttest. Prior to analysis, two outliers were eliminated. According to table 31, no functions in the discriminant analysis were significant, indicating that the seven dimensions of cannot predict whether someone is male or female based on their responses to the questions in the posttest. Finally, table 35 illustrates the structure matrix, which ranks dimensions based on correlation coefficients. These coefficients show what dimensions impact the two age groups (younger adults/older adults) the most. While there are no significant results, gender equality is shown to be the highest ranked function in the structure matrix.

Table 30 *Group Statistics for Gender Posttest Questions*

				Valid N (listwise)	
Gender		Mean	Std. Deviation	Unweighted	Weighted
Male	Post Comfort	3.5647	.66796	17	17.000
	Post Efficacy	1.7647	.53026	17	17.000
	Post Gender Equality	3.6824	.56151	17	17.000
	Post Control	2.6588	.57343	17	17.000
	Post Dehumanization	3.9510	.83076	17	17.000
	Post Interest	3.0941	.32494	17	17.000
	Post Utility	3.8529	.49959	17	17.000
Female	Post Comfort	3.4133	.60222	15	15.000
	Post Efficacy	1.8667	.54859	15	15.000
	Post Gender Equality	3.6400	.54616	15	15.000
	Post Control	2.5333	.32660	15	15.000
	Post Dehumanization	3.4778	.66329	15	15.000
	Post Interest	2.9867	.31593	15	15.000
	Post Utility	3.7000	.44186	15	15.000
Total	Post Comfort	3.4938	.63242	32	32.000
	Post Efficacy	1.8125	.53264	32	32.000
	Post Gender Equality	3.6625	.54581	32	32.000
	Post Control	2.6000	.47110	32	32.000
	Post Dehumanization	3.7292	.78260	32	32.000
	Post Interest	3.0437	.32022	32	32.000
	Post Utility	3.7813	.47224	32	32.000

Table 31 *Tests of Equality of Group Means for Gender Posttest Questions*

	Wilks' Lambda	F	df1	df2	Sig.
Post Comfort	.985	.448	1	30	.508
Post Efficacy	.991	.285	1	30	.597
Post Gender Equality	.998	.047	1	30	.831
Post Control	.982	.557	1	30	.461
Post Dehumanization	.906	3.112	1	30	.088
Post Interest	.971	.894	1	30	.352
Post Utility	.973	.831	1	30	.369

Table 32 *Test Results for Gender Posttest Questions*

Box's M		59.376
F	Approx.	1.577
	df1	28
	df2	3024.500
	Sig.	.028

Tests null hypothesis of equal population covariance matrices.

Table 33 *Eigenvalues for Gender Posttest Questions*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.150[a]	100.0	100.0	.361

a. First 1 canonical discriminant functions were used in the analysis.

Table 34 *Wilks' Lambda for Gender Posttest Questions*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.869	3.708	7	.813

Table 35 *Structure Matrix for Gender Posttest Questions*

	Function 1
Post Dehumanization	.831
Post Interest	.446
Post Utility	.430
Post Control	.352
Post Comfort	.315
Post Efficacy	-.252
Post Gender Equality	.102

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 36 *Classification Results for Gender Posttest Questions*

		Gender	Predicted Group Membership Male	Female	Total
Original	Count	Male	12	5	17
		Female	8	7	15
	%	Male	70.6	29.4	100.0
		Female	53.3	46.7	100.0
Cross-validated[b]	Count	Male	10	7	17
		Female	11	4	15
	%	Male	58.8	41.2	100.0
		Female	73.3	26.7	100.0

a. 59.4% of original grouped cases correctly classified.

b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

c. 43.8% of cross-validated grouped cases correctly classified.

4.12 Regression

A regression was run to check for multivariate outliers before the discriminant analysis could be run. When the command is run, the Mahalanobis Distance, in table 38, must be less than 24.32. If outliers are found, the Explore command is run in SPSS software, which identifies the outliers. For this study, no outliers were found.

Table 37 *Coefficients of Regression*

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	18.797	2.208		8.513	.000
	Overall S1	8.112	5.517	.322	1.470	.153
	Overall S2	2.812	6.022	.091	.467	.644
	Overall S3	-.506	4.750	-.021	-.107	.916
	Overall S4	10.637	6.023	.402	1.766	.089
	Overall S5	-1.853	4.708	-.079	-.394	.697
	Overall S6	1.612	4.282	.075	.376	.710
	Overall S7	-7.005	5.659	-.288	-1.238	.227

a. Dependent Variable: Case Number

Table 38 *Residuals Statistics of Regression*

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	8.76	28.34	17.50	4.163	34
Std. Predicted Value	-2.099	2.603	.000	1.000	34
Standard Error of Predicted Value	2.731	8.670	4.693	1.576	34
Adjusted Predicted Value	-4.81	44.04	17.91	7.030	34
Residual	-14.750	15.906	.000	9.046	34
Std. Residual	-1.447	1.561	.000	.888	34
Stud. Residual	-1.532	1.848	-.012	1.015	34
Deleted Residual	-27.044	26.806	-.412	12.461	34
Stud. Deleted Residual	-1.576	1.945	-.010	1.031	34
Mahal. Distance	1.399	22.912	6.794	5.608	34
Cook's Distance	.000	.623	.057	.125	34
Centered Leverage Value	.042	.694	.206	.170	34

a. Dependent Variable: Case Number

4.13 Discriminant (Age: post-pre)

According to table 40, no significant differences were found between younger adults and older adults from the pretest and posttest. The dimension of comfort (S1) had no significant difference ($\Lambda = .923$, X^2 (32, n = 34) = 2.673, $p > .05$). The dimension of efficacy (S2) had no significant difference ($\Lambda = .976$, X^2 (32, n = 34) = 0.790, $p > .05$). The dimension of gender equality (S3) had no significant difference ($\Lambda = .960$, X^2 (32, n = 34) = 1.316, $p > .05$). The dimension of control (S4) had no significant difference ($\Lambda = .957$, X^2 (32, n = 34) = 1.439, $p > .05$). The dimension of dehumanization (S5) had no significant difference ($\Lambda = .990$, X^2 (32, n = 34) = 0.334, $p > .05$). The dimension of interest (S6) had no significant difference ($\Lambda = .978$, X^2 (32, n = 34) = 0.718, $p > .05$). The dimension of utility (S7) had no significant difference ($\Lambda = .999$, X^2 (32, n = 34) = 0.029, $p > .05$).

Table 39 *Group Statistics for Age Posttest Score Minus Pretest Scores*

				Valid N (listwise)	
Gender		Mean	Std. Deviation	Unweighted	Weighted
Young	Overall S1	.0667	.32899	18	18.000
	Overall S2	.1111	.24944	18	18.000
	Overall S3	.1000	.33077	18	18.000
	Overall S4	.0667	.42288	18	18.000
	Overall S5	.2315	.52437	18	18.000
	Overall S6	.1222	.59067	18	18.000
	Overall S7	.1111	.39606	18	18.000

Old	Overall S1	-.1500	.44121	16	16.000
	Overall S2	.0125	.38966	16	16.000
	Overall S3	-.0625	.48836	16	16.000
	Overall S4	-.0875	.30957	16	16.000
	Overall S5	.1458	.29107	16	16.000
	Overall S6	-.0125	.24732	16	16.000
	Overall S7	.1354	.43554	16	16.000
Total	Overall S1	-.0353	.39534	34	34.000
	Overall S2	.0647	.32182	34	34.000
	Overall S3	.0235	.41419	34	34.000
	Overall S4	-.0059	.37654	34	34.000
	Overall S5	.1912	.42666	34	34.000
	Overall S6	.0588	.46064	34	34.000
	Overall S7	.1225	.40888	34	34.000

Table 40 *Tests of Equality of Group Means for Age Posttest Score Minus Pretest Scores*

	Wilks' Lambda	F	df1	df2	Sig.
Overall S1	.923	2.673	1	32	.112
Overall S2	.976	.790	1	32	.381
Overall S3	.960	1.316	1	32	.260
Overall S4	.957	1.439	1	32	.239
Overall S5	.990	.334	1	32	.567
Overall S6	.978	.718	1	32	.403
Overall S7	.999	.029	1	32	.866

Table 41 *Tests Results for Age Posttest Score Minus Pretest Score*

Box's M		54.513
F	Approx.	1.480
	df1	28
	df2	3456.202
	Sig.	.050

Tests null hypothesis of equal population covariance matrices.

Table 42 *Eigenvalues for Age Posttest Score Minus Pretest Scores*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.371[a]	100.0	100.0	.520

a. First 1 canonical discriminant functions were used in the analysis.

Table 43 *Wilks' Lambda for Age Posttest Score Minus Pretest Scores*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.729	9.003	7	.252

Table 44 *Structure Matrix for Age Posttest Score Minus Pretest Scores*

	Function
	1
Overall S1	.474
Overall S4	.348
Overall S3	.333
Overall S2	.258
Overall S6	.246
Overall S5	.168
Overall S7	-.049

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 45 *Classification Results for Age Posttest Score Minus Pretest Scores*

			Predicted Group Membership		
		Age Group	Young	Old	Total
Original	Count	Young	14	4	18
		Old	7	9	16
	%	Young	77.8	22.2	100.0
		Old	43.8	56.3	100.0
Cross-validated[b]	Count	Young	12	6	18
		Old	7	9	16
	%	Young	66.7	33.3	100.0
		Old	43.8	56.3	100.0

a. 67.6% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 61.8% of cross-validated grouped cases correctly classified.

4.14 Discriminant (Gender: post-pre)

According to table 47, no significant differences were found between younger adults and older adults from the pretest and posttest. The dimension of comfort (S1) had no significant difference (Λ = .1.000, X^2 (32, n = 34) = 0.000, p > .05). The dimension of efficacy (S2) had no significant difference (Λ = 0.997, X^2 (32, n = 34) = 0.099, p > .05). The dimension of gender equality (S3) had no significant difference (Λ = 0.993, X^2 (32, n = 34) = 0.241, p > .05). The dimension of control (S4) had no significant difference (Λ = 0.970, X^2 (32, n = 34) = 1.004, p > .05). The dimension of dehumanization (S5) had no significant difference ($\Lambda = 0.993$, X^2 (32, $n = 34$) = 0.215, $p > .05$). The dimension of interest (S6) had no significant difference ($\Lambda = 1.000$, C^2 (32, $n = 34$) = 0.000, $p > .05$). The dimension of utility (S7) had no significant difference ($\Lambda = 0.967$, X^2 (32, $n = 34$) = 1.103, $p > .05$).

Table 46 *Group Statistics for Gender Posttest Score Minus Pretest Scores*

Gender		Mean	Std. Deviation	Valid N (listwise) Unweighted	Valid N (listwise) Weighted
Male	Overall S1	-.0353	.43724	17	17.000
	Overall S2	.0471	.28748	17	17.000
	Overall S3	.0588	.48355	17	17.000
	Overall S4	.0588	.38578	17	17.000
	Overall S5	.1569	.27933	17	17.000
	Overall S6	.0588	.35189	17	17.000
	Overall S7	.1961	.46486	17	17.000
Female	Overall S1	-.0353	.36218	17	17.000
	Overall S2	.0824	.36096	17	17.000
	Overall S3	-.0118	.34257	17	17.000
	Overall S4	-.0706	.36702	17	17.000
	Overall S5	.2255	.54308	17	17.000
	Overall S6	.0588	.56020	17	17.000
	Overall S7	.0490	.34240	17	17.000
Total	Overall S1	-.0353	.39534	34	34.000
	Overall S2	.0647	.32182	34	34.000
	Overall S3	.0235	.41419	34	34.000
	Overall S4	-.0059	.37654	34	34.000
	Overall S5	.1912	.42666	34	34.000
	Overall S6	.0588	.46064	34	34.000
	Overall S7	.1225	.40888	34	34.000

Table 47 *Tests of Equality of Group Means for Gender Posttest Score Minus Pretest Scores*

	Wilks' Lambda	F	df1	df2	Sig.
Overall S1	1.000	.000	1	32	1.000
Overall S2	.997	.099	1	32	.755
Overall S3	.993	.241	1	32	.627
Overall S4	.970	1.004	1	32	.324
Overall S5	.993	.215	1	32	.646
Overall S6	1.000	.000	1	32	1.000
Overall S7	.967	1.103	1	32	.301

Table 48 *Test Results for Gender Posttest Score Minus Pretest Scores*

Box's M		63.370
F	Approx.	1.724
	df1	28
	df2	3568.203
	Sig.	.010

Tests null hypothesis of equal population covariance matrices.

Table 49 *Eigenvalues for Gender Posttest Score Minus Pretest Scores*

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.111[a]	100.0	100.0	.317

a. First 1 canonical discriminant functions were used in the analysis.

Table 50 *Wilks' Lambda for Gender Posttest Score Minus Pretest Scores*

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.900	3.010	7	.884

Table 51 *Structure Matrix for Gender Posttest Score Minus Pretest Scores*

	Function
	1
Overall S7	.556
Overall S4	.531
Overall S3	.260
Overall S5	-.245
Overall S2	-.167
Overall S6	.000
Overall S1	.000

Table 52 *Classification Results for Gender Posttest Score Minus Pretest Scores*

		Gender	Predicted Group Membership Male	Female	Total
Original	Count	Male	11	6	17
		Female	7	10	17
	%	Male	64.7	35.3	100.0
		Female	41.2	58.8	100.0
Cross-validated[b]	Count	Male	7	10	17
		Female	11	6	17
	%	Male	41.2	58.8	100.0
		Female	64.7	35.3	100.0

a. 61.8% of original grouped cases correctly classified.

b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.

c. 38.2% of cross-validated grouped cases correctly classified.

4.15 Summary of the Study

Wearable technology is a very popular piece of equipment in today's society, and has grown significantly over the past few years. However, while they are very popular, they still need to find ways to improve the devices, to accommodate a changing market. Many strides have been taken to provide a quality product to consumers, but it is important to continue to search for trends, make improvements to these products, and understand what the consumer requires. With any product or service, it is important to keep searching for new trends, and find ways to improve. Currently, these devices could be used to help students learn both content related to statistics and about physical activity in general (Lee, 2015). The possibilities are endless with wearable technology because technology is always improving, and we can see this with yearly product releases. Every year, a different wearable technology device is introduce, whether it is from Fitbit, Jawbone, or many others, we can see the improvements being made with each new release.

Also, it is important to search for these trends, and make improvements because a lot of individuals need that extra motivation to exercise. Obesity in the United States continues to contribute to a number of serious health issues such as cardiovascular disease, stroke, diabetes, and even some cancers (Gowin et al., 2015). Inactivity is closely associated with chronic diseases and rising healthcare costs (Noah, Spierer, Gu, Bronner, 2013). With these devices, we can try to assist adults with their exercise habits, and increase their time spent in the gym, or doing physical activity.

The most important rationale behind this research study was to provide information on the attitudes of wearable technology device users, and determine what features might need to be improved in future devices. The purpose of this study is to introduce adults to wearable technology devices, and examine their attitudes toward these devices.

A total of 34 participants took part in this study, which took place over a two-week period.

Participants include 18 younger adults, and 16 older adults, which can be further broken down by a total of 17 males, and 17 females. Throughout this study, few problems occurred with the devices, other than a few batteries running out. All participants were able to access a device during their two-week period.

5.Conclusion

In conclusion, this study shows a few significant results. Firstly, dehumanization scores from the pretest (M = 3.51, sd = .80) increased significantly in posttest (M = 3.70, sd = .82). Therefore, participants found wearable technology less dehumanizing after using a device for a two-week period. Also, efficacy scores for younger adults (M = 1.53, sd = .48) and older adults (M = 1.96, sd = .44) in the pretest were significant, and can be used to predict age groups in the sample population. Therefore, the dimension of gender equality can significantly affect adult user's attitude in regards to wearable technology. Finally, gender scores for younger adults (M = 3.86, sd = .53) and females (M = 3.46, sd = .50) in the posttest were significant, and can be used to predict age groups in the sample population. Therefore, the dimension of gender equality can significantly affect adult user's attitude in regards to wearable technology. As a whole, there were not many differences between the groups (male/female and younger adults/older adults), which could mean that the different age groups are not significantly different from each other.

The findings of this study show that introduction of wearable technology devices provide users a better understanding of these devices, and have shown that adult users of all ages and genders generally view the devices the same. Participants felt that wearable technology became less dehumanizing after using the device, so they felt that computers were more convenient. Participants felt that wearable technology increased the dimension of efficacy, which means that they felt more competent towards the technology. Finally, participants felt that gender equality was equal among both genders. While there were not many significant differences among groups, this does show that these groups view the devices similarly. So, according to the results of this study, wearable technology devices can be promoted to all age groups and genders similarly. However, there is a need for future research, as there were limitations to the study.

6.Direction for Future Research

As a whole, there were not many differences between the groups (male/female and younger adults/older adults). It could be beneficial to focus on the dimensions, which showed significant differences among the groups: efficacy in the pretest, and gender equality in the posttest. Efficacy was the only function, which could predict whether someone is young or old based on their responses to the questions in the pretest. Gender equality was the only function which could predict whether someone is young or old based on their responses to the questions in the posttest. Based on these results, further research could be conducted on these dimensions. Also, it would be beneficial to future research to recruit a larger sample size, as well as compare the results of multiple university and or organizations, which can implement the wearable technology device. In this study, only the Moov Multi-Sport Wearable Coach was used, which limits the attitudes of participants solely on that device. For future research, the comparison of multiple wearable technology devices would be beneficial, as this study only utilized one device. Additional devices could potentially give participants a wider view of what wearable technology is, and the different features associated with different devices.

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