CALIFORNIA STATE UNIVERSITY
MONTEREY BAY

Get Up and Move© (GUM©)

CAPSTONE PROJECT Report

Submitted in partial satisfaction of requirements of the degree of

MASTER OF SCIENCE
in
Instructional Science and Technology

Mark C. Angel
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Capstone Approvals:

Miguel Lara	_____	_____
Advisor Name	Signature	Date

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Get Up and Move: Executive Summary

The Get Up and Move (GUM) program was developed to address wellness gaps respecting sedentary trends and habits in the home and workplace. The COVID-19 pandemic exacerbated the already aggregious international sedentary pandemic that existed throughout the developed world. Remote office work, remote learning, and video conferencing and communication make the need for programs like GUM all the more essential to the general public during present times more than ever.

One of the principle elements in the project is to convey the value of moving more frequently throughout the day, and then provide a series of sessions to guide people through activities that are geared towards their paticular physical abilities. Research has shown that what matters most is not just the time commited to physical activity in any given day or week, but the intervals that break up extended periods of sedentary time (sitting more than a half-hour to an hour).

The GUM Orientation Course was designed and developed using LUMI H5P software. The orientation course was evaluated, and revised to deliver a comprehensive 1-hour asynchronous training. Some of the videos used were completely original work, others were linked from public sources. The initial structure of the GUM website www.getupandmove.net, and the GUM moble app for Android platforms were developed with the assistance of a team of senior CST students for their capstone project last Spring.

The GUM project addresses the one key gap that endangers the lives of so many people in our times—sitting too much. The GUM Orientation Course and the accompanying website and app will encourage people to get up and move more throughout their day. The GUM program includes a 1-hour knowledge and activity orientation (online asynchronous course), a mobile application (currently only for Android platforms) to induce users to take breaks every hour or so during sedentary time, and a website (www.getupandmove.net) which provides additional information and facilitates activity sessions for those who can’t access the mobile app.

Data collected in the evaluation process of the GUM program during the summer term of 2021 (IST624-90_SP21: Research Design & Methods) was compiled and analyzed. The evaluation summarized results of a pre-test and post-test for the GUM orientation didactic learning session developed in the spring semester of 2021. The evaluation showed a significant improvement in participant knowledge after taking the knowledge portion of the GUM orientation course. Data will continue to be collected as the program evolves, and feedback will continue to be assessed and integrated into revisions of the program over time, to improve the efficacy and reach of GUM and the app associated with the program. Ultimately, the GUM project delivers an effective wellness awareness and training program that will have an beneficial impact on the people who most needed it.

Introduction and Background

“Sitting is the new smoking,” a quote attributed Dr. James Levine of the Mayo Clinic, is now a popular catchphrase. In his 2014 interview with the L.A. Times, he went on to say: "Sitting is more dangerous than smoking, kills more people than HIV and is more treacherous than parachuting. We are sitting ourselves to death" (Macvean, 2014). Although determining which is worse has been debated, the comparison to smoking is apt because like smoking, people first choose to sit excessively, and then it becomes a life-long habit. Also like smoking, no matter how much exercise one dose before or after long stints of sitting, it won’t reverse all the damage done by hours of sitting every day. One might also say that sedentary behavior, like smoking, can be addictive since the more one sits, the harder it is to get up and move.

Sedentary behavior, especially when one is performing office work, has become a significant topic of interest for public health and occupational health. It has been considered a global pandemic since 2012 (Guardian Media Newsroom, 2021). This expansion over the past few decades seems to have accompanied the growth and development of internet-based school and employment, which keeps people at their desks and watching screens more than ever. Recent research has already shown that the

COVID -19 pandemic has highlighted and greatly exacerbated this trend (Flanagan et al., 2021). And evidence supports the assertion that mortality from COVID-19 is substantially increased by a sedentary lifestyle (Salgado-Aranda et al. 2021).

At the Healthy Living for Pandemic Event Protection (HL-PIVOT) Network, in Chicago, Illinois, Smirmaul et al. (2020) show that:

> The coronavirus disease-2019 (COVID-19) pandemic containment and mitigation strategies may lead to excessive physical inactivity and sedentary behavior, drastically impacting cardiorespiratory fitness and overall health. It is urgent to safely find ways to sit less and move more.

Literature Review

According to the World Health Organization, excessive sedentary behavior is not only a salient issue for world wide public health (WHO, 2020), it is a serious economic concern (Carlson, 2015). The economic impact is not only direct, through medical costs for taking care of those who develop disease because of inactivity, it has many indirect impacts like days absent from work, health insurance costs, productivity declines, morale issues, and workplace injuries to mention a few (Buckley, 2015).

Sitting not only contributes to all-cause mortality rates in many categories, it is in itself considered a leading cause of death in the world. The WHO (2011) identified phyical inactivity as the fourth leading risk factor of global death after high blood pressure, smoking, and high glucose. And levels of physical inactivity at the time were rising in many countries. It is clear that a broad spectrum solution is needed that can be easily distributed to a massive amount of people in a very short time to have a substantial and timely impact on this world wide sedentary epidemic.

Carlson et al. (2018) reviewed data collected by the National Health Interview Survey (NHIS) including 67,762 non-disabled adults, over a 21-year period from 1990 to 2011. Out of 18,796 incidences of death recorded, Carlson et al. (2018) found:

Overall, 8.3% of deaths in nondisabled adults 25 years or older were attributed to inadequate levels of physical activity. The percentage of deaths attributed to inadequate physical activity was significant for adults aged 40 to 69 (9.9%) and among adults aged 70 or older (7.8%).

Therefore, it seems that researchers must crefully consider whom they use for control groups in health related studies. Because the "average healthy adult" is often just one who doesn't currently present with chronic or acute disease, it is necessary to seek out "active, healthy adults" as a control group for health related studies to be more reliable, or at least be more spcific about the control group's health.

Definition of Sedentary Behavior

In an article in the *British Journal of Sports Medicine* (Buckley *2015),* an international group of experts offers guidance to employers on the dangers of maintaining a sedentary workforce. Based on evidence from long-term epidemiological and interventional studies of sedentary workers who were encouraged to stand and move more frequently, their recommendation is that, "Desk based workers should aim to initially progress towards accumulating 2 h/day of standing and light activity (light walking) during working hours, eventually progressing to a total accumulation of 4 h/day (prorated to part-time hours)" (Buckley, 2015). This expert recommendation went further to encourage employers to promote other healthier habits, and discourage dangerous habits with respect to diet, smoking, and stress. Buckley showed that encouraging simple and attainable behavioral changes in the habits of sedentary workers promotes a decrease in the risk of cardiometabolic diseases and premature mortality.

The primary challenge of the GUM program is to convince people that they need to move more. And only then to provide them with activities that help them stand and move in particularly beneficial ways. In fact, their very lives depend on simply getting their acetabulum out of the chair as much as possible. From a physical health perspective in the United States, "Americans spend the majority of their time in behaviors that expend very little energy (Matthews, 2003-2004)." At the time of

Matthews' study, only about half of non-sleeping sedentary time was attributed to media use. A recent study published by Flanagan et al. (2021) shows that COVID-19 has contributed significantly to an uptick in sedentary behavior, much of which is related to even more remote work and social activity, and that sedentary behavior itself is one of the many detrimental effects of the pandemic.

Excessive sedentary behavior is any time one sits or reclines more than a half-hour to an hour at a time outside of regular sleep hours. That includes desk work, driving, watching TV, and so fourth. And one would further benefit from limiting sedentary behavior to a total of no more than four to six hours in a day. As an expert in the field, I have observed that since the turn of this century, and especially since the pandemic took hold, there is even less physical activity among people I teach and interact with due to an increase in the time spent using media and other sedentary activities.

The Effects of Sedentariness

In a meta-analysis of 47 articles (selected from nearly 21,000 studies related to the topic), Biswas et al. (2015), found that there is a significant correlation between prolonged sedentary behavior and comorbidity factors for cardiovascular disease, diabetes, obesity, musculoskeletal disorders, and several other disabling conditions. Even considering publication biases, there is compelling evidence that sitting less than an hour at a time and fewer than four hours throughout the work-day (Buckley, 2015) significantly decreases associated comorbidity factors. Katzmarzyk et al. (2019) also showed "strong evidence that heightened amounts of sedentary behavior increases the risk for all-cause and cardiovascular disease mortality." They also associate too much sitting with cancer, obesity, type-2 diabetes, and other diseases.

The Centers for Disease Control and Prevention recommends that all adults get at least 150 minutes per week of moderate to vigorous activity (CDC, 2020). After sitting for an hour or so, basal metabolic rate sinks to about 1-calorie per minute. By simply standing and changing posture while

working at a desk, one can increase caloric burn by up to 2-calories per minute through Non-Exercise Activity Thermogenesis (Levine, 2004). Biswas (2015) concluded that exercising after work will not significantly mitigate or reverse the damage caused by sitting too much throughout the day (Buckley, 2015).

Another study by Patel et al. (2018) took a new look at data collected on 127,554 people (free of initial chronic disease at the outset) between 1993 and 2014 to assess the impact of leisure time on all cause mortality. This review showed that sedentary leisure time like playing video games, watching television, and reading for example, for over six hours a day as compared to less than three hours a day, led to nearly 20% increased likelihood of all cause mortality. This related to, "higher risk of mortality from all causes, cardiovascular disease (including coronary heart disease and stroke-specific mortality), cancer, diabetes, kidney disease, suicide, chronic obstructive pulmonary disease, pneumonitis due to solids and liquids, liver, peptic ulcer and other digestive disease, Parkinson disease, Alzheimer disease, nervous disorders, and musculoskeletal disorders" (Patel et al. 2018).

Costs to Self and Society

Carlson et al. (2015) showed that "8.7% of aggregate health care expenditures were associated with inadequate physical activity" (Carlson, 2015). And that getting people to be more active could result in a substantial decrease in health care expenditures in the United States and worldwide. The above statistics show that chronic sedentary behavior is at least 40 times more likely to kill a worker than the incidents of more-active workers dying from an injury in all the other dangerous jobs put together. Based on these numbers, sedentary behavior could be considered the fourth leading cause of death in the United States after heart disease, cancer, and COVID-19 (Bureau of Labor Statistics, US Department of Labor, 2020). This also creates a significant financial burden on the health care system. The estimated costs directly related to sedentary behaviors in the United States from 2006 to 2011 was $117 billion annually. This does not include indirect costs such as loss of productivity, or institutional

costs from premature death and disability associated with illness and injury caused or made worse by inactivity (Carlson et. Al, 2015). A panel survey considering economic impact moderate to vigorous activity, conducted by Valero-Elizondo et al. (2012), shows that there is strong evidence that the health care expenditures and resource utilization decreases significantly for people who meet the CDC and WHO activity guidlines of at least 150 minutes per week. And only about 20 percent of American adults meet that guideline.

In the United States alone, the number of people who spend more than four hours a day sitting at a desk is staggering. The harm this sedentary lifestyle causes those workers is well documented (Biswas et al., 2015). What makes it even worse is that many of those more sedentary people already have pre-existing conditions that make their circumstances even more dire and more difficult to overcome. In order to minimize that danger, it is necessary for them to move intentionally and more often throughout the day. According to van der Ploeg (2012), regular exercise scattered throughout the day is much more effective in combating the dangers of sedentary behavior than clumping it together (i.e., going to the gym). “Prolonged sitting is a risk factor for all-cause mortality, independent of (overall) physical activity. Public health programs should focus on reducing sitting time in addition to increasing physical activity levels” (van der Ploeg et al., 2012). Therefore, just doing the CDC minimum recommended exercise for a week, or even that much in a day does not counteract all of the negative effects of sitting more than one hour at a time without getting up and moving.

Furthermore, exercise doesn’t have to be something to dread. Beneficial physical activity is considered any behavior that gets the body moving. Therefore, getting people out of their desk-chair—or off the couch—to stand and move more while at work (even while conducting business) is key to keeping people awake, focused, motivated, healthy, at work, doing work, and alive.

Not only is regular movement essential to one’s general physical health, it is also immensely helpful to one’s brain. One might argue that the most active part of a person who is primarily engaged in more sedentary types of work is their brain.

Benefits to the Brain from Mobilizing

According to Wendy Suzuki (2020), “Exercise is the most transformative thing you can do for your brain today.” She gives three salient reasons in support of that statement:

1. Exercise immediately increases the amount of neurotransmitters, enhancing mood and a general sense of wellbeing.

2.Exercise increases attention and causes a lasting effect on the ability to focus.

3. Exercise sharpens the mind’s activity and improves one’s reaction time.

Longer lasting effects, of exercise on the brain over time, include growing brain cells, which actually increase brain volume and long term memory. There are also marked improvements in attention function, and longer lasting mood enhancing effects. One example of the protective effects of having a bigger, stronger, and faster pre-frontal lobe and hippocampus is that the brain can resist the onset of dementia and Alzheimer disease longer as one ages.

There is much consensus that exercise is indeed great for one’s health. Again, what may surprise people is that just putting in an hour or so at the gym before or after work will not fully mitigate the deleterious effects of too much sustained sitting. One must get up and move often throughout the day (Biswas, 2015).

Promising Interventions that Address Sedentary Behavior

So how does one get people to change their damaging sedentary habits? How does one learn to get people to get up and move throughout the day? A research review by Gardner et al. (2016) found that some interventions worked better than others with respect to successfully changing people’s habitual sedentary behavior. The most promising interventions were based on persuasion, education, and environmental restructuring (e.g., setting up a standing desk), to get people to be less sedentary. Gardner et al. (2016) takes a look at what could be considered instructional technology driven approaches to the solution for sitting too much. In the review, 26 studies were considered, investigating

38 different interventions. It was found that placing an emphasis on educating sedentary people as to the dangers of sedentary behavior was much more effective than just focusing on generally encouraging them to increase their exercise. This study focused on trying to find the most successful interventions and best practices for getting people on their feet and moving more often throughout the day.

Gardner et al. (2016) shows that the most promising interventions investigated include:

- self-monitoring of sedentary behaviors and exercise (e.g., pedometer);
- problem solving activities that address sedentary behavior and movement (e.g., time management);
- modifying social and physical environments in the work-place (e.g., standing desk); and,
- giving subjects clear information as to the dangerous health impacts of too much sitting.

These results were similar to previous work identifying the use of standing desks and personalized behavioral advice as effective in reducing sedentary behavior (Shrestha et al., 2015).

Among the most commonly used techniques that worked to get people moving more were setting behavioral goals, providing social support, and utilizing activity monitors and sit-stand desks. Education, environmental restructuring, and enablement were often used with more success than trying to get people to exercise more. According to Gardner et al. (2016):

> This suggests that intervention developers have tended to conceive of sedentary behaviour as largely determined by external environments, or as a self-regulatory problem, and that people would be willing to reduce their sedentary time if the environment were modified, or if supported in developing self-regulatory skills for sitting less.

Other studies have shown that the self-regulatory behavior change techniques described above are even more effective when combined, rather than just applied independently (Dombrowski et al., 2012; Michie et al., 2009).

Solution Description

What is the worst thing that can happen if you just do your job? Perhaps that depends on the kind of job you have. If you work in fire or emergency medical services, you can get burned, blown-up, hit by a car, catch a disease from a patient, or die of cardiac arrest while performing your duties. If you are soldier, you can also get into all sorts of trouble during war time and training. If you are a cop, you might get shot or prosecuted for shooting someone else. According to the Bureau of Labor Statistics, US Department of Labor (2020) workplace fatalities due to injury were 5,333 in 2019. That is a rate of about 3.5 per 100,000 full-time equivalent workers, or about 0.2% of the total deaths for that year.

But what if you work behind a desk? It may surprise some people that sedentary work is one of the most dangerous jobs in the world. A preponderance of evidence shows that sitting too much contributes significantly to disease, and is a cofactor in workplace injury. The World Health Organization (WHO, 2011) listed too much sitting as the fourth leading cause of non-communicable disease worldwide. The theory that sitting too much is dangerous is well grounded in evidence presented in the literature review. As shown in Figure-1 below, the "Sitting Disease" is indeed prevalent and deadly. The theory that moving more throughout the day to break up bouts of sitting is also grounded in evidence from several studies. This paper will show how the GUM program provides a solution to these widespread problems?

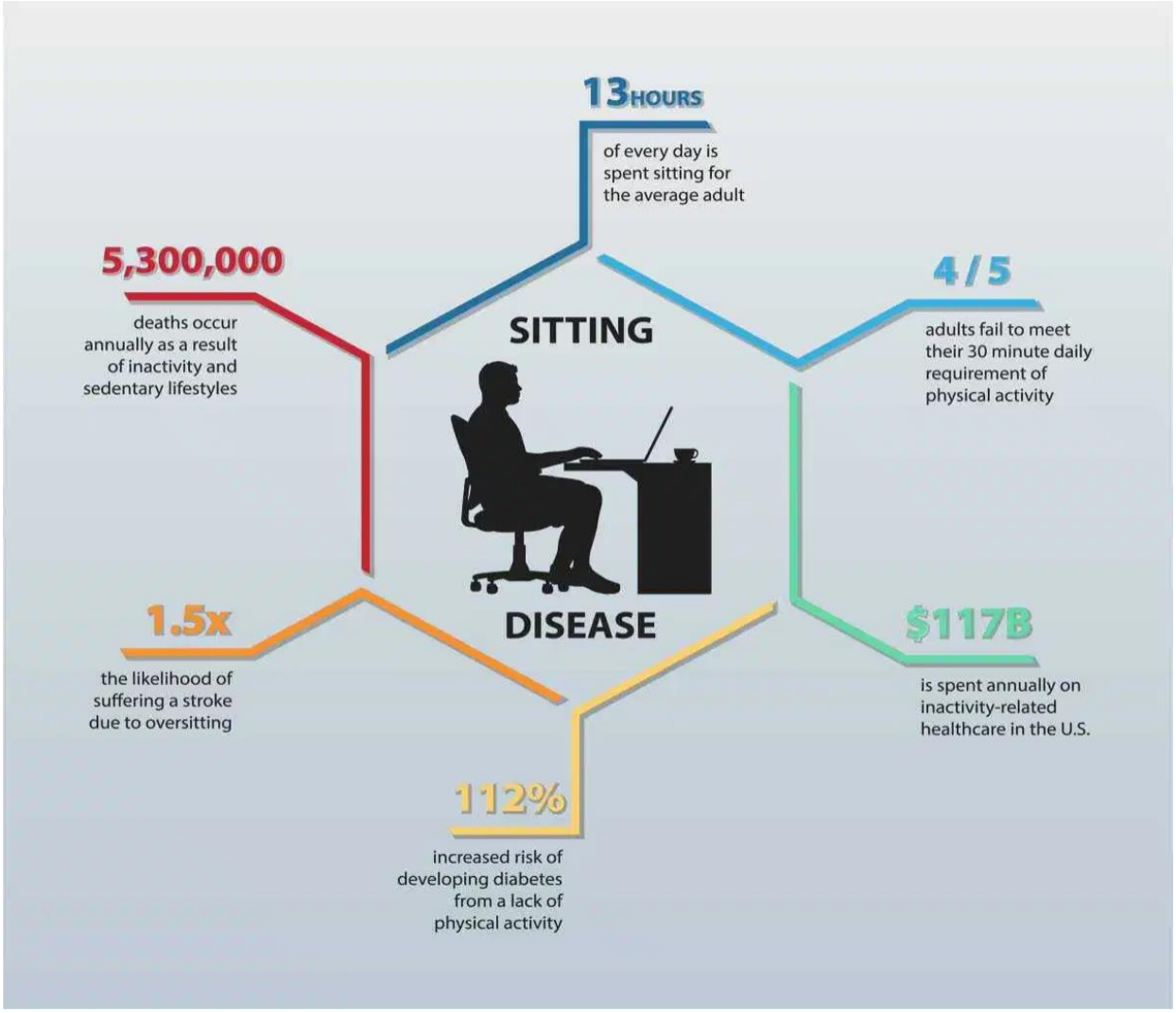

Figure 1: The 'Sitting' Disease: Did COVID-19 Worsen Our Risk? (2021, January 25) Guardian Media Newsroom

Shuval et al. (2013) studied urban community residents to see what they thought about physical activity. The study established that people are generally well aware that more activity is good for them, but find there are many barriers to getting more activity, especially in the inner city. The purpose of this project is to produce a GUM orientation course, mobile app, and website as tools which can be part of the solution to reduce those barriers to more activity, and to expand accessibility of convincing evidence and simple, effective movement techniques.

The GUM orientation course is an introductory class that teaches participants about the dangers of sitting, and how to take advantage of the GUM program including the mobile app and website. The

orientation program will help users understand just what sedentary means, how many hours of sedentary behavior per day constitutes a sedentary lifestyle, and what happens when one is excessively sedentary. It will also inform users of the degree to which a sedentary lifestyle affects the individual's health, and its impact on workforce productivity and the health care system. The program will also offer solutions that have been proven to help prevent, and in some cases even reverse some of the damage done by sedentary behavior. Finally, the activities taught in the GUM orientation and presented in the 5-minute guided sessions on the app and website will promote a highly effective strategy to help people be more active throughout the day.

Instructional technology (IT) is devoted to bringing about change in people. Get Up and Move accomplishes this by providing participants with access to evidence, motivation, demonstration, and other effective forms of interventions in order to affect changes in behavior. GUM targets gaps in behavior that, once addressed, help people become more efficient, effective, healthy, happy, and productive among other things. The role of GUM, with respect to the dangers of and interventions for sedentary work, includes but are not limited to:

- identifying gaps that lead to a predominance of sedentary behavior;
- designing and developing optimal interventions that address these gaps;
- implementing effective solutions that decrease sedentary behavior; and,
- evaluating the efficacy of said solutions.

Therefore, the GUM goal to help people break their sedentary habits, effectively implements the tools and techniques promoted in instructional science and technology.

Learning Theory

The GUM program primarily involves behavioral modification. The goal of this project is to get people to change their habitual sedentary behavior and behave differently from how they are

accustomed. That means, instead of sitting at their desk for hours on end, to get them to get up and move at least every hour. This process can be categorized in learning theory as behaviorist in nature. One can clearly be observed getting up and moving at regular intervals throughout the day, and one may even be condition to get up and move by a watch, clock, website, or app. When the timer goes off, the participant will stand up and do a practiced routine or just stand for a while while continuing to do their work. And by incorporating a little gamification into the GUM app, a user may even get a sense of reward when performing regular sets of movement.

There is a cognitive aspect to this program as an effort is made to approximate Gagne's theory of instruction as represented by Harasim (2012, p. 50-51). The GUM Orientation has particular learning outcomes and sets specific conditions for learning, while Gagne's nine events of instruction are considered throughout the instruction. And in a short time, participants develop a fairly high level of automaticity with the basic routines that form the foundation of GUM.

There is also a constructivist aspect to GUM in that practitioners are guided through activities that they will associate with longevity and improved health. And by doing the activities themselves, they can relate the practice directly to the experience of decreased pain and lethargy, and increased flexibility, mobility, balance, and strength. Clearly, this is also a representation of Learning-by-Doing that is key to the constructivist approach.

Furthermore, some of the GUM activities are directly associated with improvement in function of certain organ systems that go beyond the Western concept of exercise. These bridge to the healing philosophies of traditional Chinese medicine and Taoist healing practices, potentially making one's participation in GUM a transformative process.

Instructional Strategies

If there was one instructional strategy that most completely encompasses the GUM approach, it is Merrill's First Principles. In the 1-hour Orientation to the GUM program, First Principles are clearly evident as participants are provided with a series of exercises that are task-centered. Cognitive recall employed in the didactic phase of the Orientation helps learners relate to new information and evidence, as well as reinforce the value of the exercises and the concept of periodic interval practice. Participants observe the learning videos and are encouraged to review them as necessary if they get confused while practicing the 5-minute guided sessions. The guided sessions are where the activity skills they have learned in the orientation are applied. And finally, participants are encouraged to integrate these 5-minute activity session into their every-day lives to break up habitual sedentary behavior.

GUM is based on a learner centered design paradigm greatly elaborated on by Reigeluth (2017). The program serves as guidance for a participant to practice and develop new skills related to movement techniques. There is a fair amount of direct instruction involved in GUM. The Orientation makes it clear what the problem is—too much sitting—and supports the assertions with evidence from well established research sources. The dangers are also stated clearly, serving as a possible "hook" to propel the participants into completing the course and performing the helpful activities to avoid those dangers. And there is guided practice and closure as well. And in the skills development sections, participants are learning complete movement sets for which their understanding deepens over time. This is engaging the van Merriënboer's 4C/ID model involving whole task practice from the outset with spiraled skills development based on mastery learning as well as physical fitness improvements.

Solution

GUM is intended to help people move more, especially if they have desk work, spend a lot of time on screens, or tend to sit more than four hours in any given day. GUM is made up of six 5-minute

sessions, each illustrating a different kind of activity. Taken together, the segments amount to 30 minutes of mild to moderate and sometimes vigorous exercise, which is meant to be spread throughout a work day. If done in its entirety each day, in 5-minute sessions between bouts of sedentary activity five days a week, it will meet the Center for Disease Control and Prevention (CDC)'s minimum recommendation of 150 minutes of exercise a week (CDC, 2020). Of course, more exercise is better, and getting more aerobic and weight bearing exercise is also important.

GUM is a comprehensive lifestyle initiative that can be applied at many levels to help participants establish healthier habits and routines. Participants who regularly utilize the program will not only realize physical benefits from practicing the prescribed exercises, they will realize emotional and psychological benefit as well. They may even begin to understand why the Taoist arts such as Qigong and Taiji are not only physical and mental practices, but are also considered spiritual pursuits.

One of the benefits of basing the program on traditional Taoist teachings is that these practices and ideas have proven to be effective over centuries of practice. The Qigong movements and concepts taught in this program are drawn from a mix of lineages, but are well established in Chinese traditions and texts. The supplemental exercises are based on physical therapy, structural kinesiology and traditional yoga asanas. The meditation and visualization practices are primarily Taoist, with influence from other eastern and western traditions.

Goals of the GUM project

- Design the GUM instructional program.
- Develop a website with supporting audio/visual demonstrations.
- Develop a mobile app that helps remind people to move and guides them in beneficial activities.
- Develop audio/visual material to support the individual learning episodes/classes.
- Evaluate program efficacy using participants from CSUMB.

- Revise the program based on what is learned from the initial program implementation.
- Offer the GUM program to as wide a public audience as possible after graduation.

Learning Objectives

- Participants will be able to assess their own lifestyle and attitudes, and identify where they could make changes that would improve their health and extend their lives.
- Participants will be able to choose from a list the diseases that are caused or exacerbated by sedentary behavior.
- Participants will be able to recognize and correct dangerous sedentary behavior at home and at work.
- Participants will be able to perform a series of six basic sets of activities that help improve balance, circulation, mobility, strength, relaxation, and general well being.
- Participants will be able to identify how each exercise is conceived to affect particular physical and psychological benefits.
- Participants will be able to perform basic standing and moving meditations and visualization practices that help reduce stress, lower blood pressure and alleviate emotional distress.
- Participants will be able to access the online platform (getupandmove.net) that will help them learn, understand, and continue the process of transformation presented in the GUM program.

Methods and Procedures

The GUM Orientation Course is an approximately 30-minute lesson that includes text, audio, video, and images to present information. Plus, various interactive items are included to engage participants and reinforce learning. Additionally, there are six 5-minute guided activities for each

activity level. Providing a total of at least one hour of learning and guidance to each participant. The course is designed to be completed independently so users should be capable of completing the lesson without additional instruction or guidance. The strengths of the instructional program include it being engaging and free from technical errors. It also considers the wide range of users in the target audience and includes additional support for navigation and accessibility. Because this course is a prototype, its most obvious weakness involves some of the videos that have been included, which will need to be remade in the future. For example, most of the GUM videos have problems with uneven audio volumes. A final weakness to be considered is that while the instructional topic is relevant to all users, some people resist learning that encourages lifestyle changes, creating a barrier that could interfere with learning outcomes in some cases.

Resources

Resources developed during this capstone project include the GUM orientation course, the GUM mobile app, the GUM website.

Four students from CST499 were instrumental in developing the mobile app, database, and website in the Spring of 2021 as their own capstone projects. The website is still under development to make it even more interactive and user friendly. The GUM app needs to be reformated to it is a smaller file that links to the guideing and teaching videos and animations instead of embedding them. It is unknown at this time if this will be accomplished by outside sources or internally.

Timeline

January, 2020

- Enter the CSUMB as Open Univertsity student and begin MIST courses

May, 2020

- Complete preliminary draft of Capstone Project Proposal

August 2020

- Matriculate in the MIST Program
- Revise overall concept of Capstone Project reducing the scope to a 1-hour lesson and supporting website and app.

January 2021

- Recruit a team of four seniors in the CES program to help build a mobile app and website to teach the GUM program and promote the activities and outreach
- Develop the preliminary H5P GUM Orientation Presentation

May 2021

- Complete first version of the GUM orientation program (deliverable)
- Complete first version of the GUM application for mobile device (deliverable)

June 2021

- Solicit research subjects and with the aid of my MIST team mates revise and evaluate the learning module of the GUM H5P Orientation Presentation
- Gather results of Preliminary Mixed Questionnaire and contact information

July-September 2021

- Further revise GUM program based on evaluation and prepare final proposal

October- November 2021

- Complet other deliverables for the MIST Capstone project and presentation

December 2021

- Submit final project report and capstone project (GUM Orientation and Website)

January-June 2022

- Promote and distribute GUM program to a wider audience (deliverable)
- Recruite a team of seniors from the CES department to help revise the GUM app and develop it for the iOS platform

Evaluation

The following three sections of this paper (Evaluation, Methodology, and Summary) have been excerpted from a report done by Mark Angel, Lisa Lark, and Maricel Manglicmot as required by Dr. Bude Su in the IST622—Assessment and Evaluation course over the Summer of 2021, for Instructional Science and Technology, California State University, Monterey Bay.

This evaluation section examines results from a pre/post-test evaluation of the Get Up and Move (GUM): Orientation Course (Appendix A: revised version), an interactive multimedia lesson created in H5P. This orientation course is designed to introduce people to evidence-based information about the dangers of sitting too much throughout the day, provide some simple solutions, and introduce participants to the GUM website and app. In the future, the goal of this orientation course will be to recruit new users to the GUM program and mobile application. However, because the app and website are still under development, the goal of this evaluation was to directly measure learning outcomes.

Learners

The target audience for this evaluation was broad. Different email templates (Appendix B) were used to invite approximately 200 people to participate. Ultimately, 41 people started the program and 36 completed all three stages. With the exception of the twelve year old son of one of the evaluators, all test subjects were adults from diverse age ranges, levels of education, abilities, and cultural backgrounds. Most participants had little prior knowledge of the program, and there were no prerequisite skills required; only a readiness to participate to the best of their abilities and complete the course.

Process

The evaluation process included three items completed in order by each participant: Google Form pre-test (Appendix C), GUM Orientation Course (Appendix A: revised version), and Google Form post-test (Appendix D). After agreeing to participate, subjects were provided with instructions including a link to the ten item pre-test. This Google Form automatically provided users with the link to

the orientation course once their answers had been submitted. The post-test was accessed by a link at the end of the orientation course. The post-test included the same ten items as the pre-test, in addition to a reaction questionnaire. The results of the pre and post-tests were analyzed using Excel. Some pre-test scores were eliminated in the analysis process if the subject did not also have a post-test score, resulting in only paired pre/post-test data for a total of 36 subjects.

After selecting the GUM Orientation Course for evaluation, the team revised or re-created all necessary instruments. The ten pre/post test items were created first and were written to assess the learning goals outlined in the orientation course. These ten test items provided balanced coverage of learners' ability to identify:

- a sedentary lifestyle or workplace.
- the minimum amount of physical activity recommended by the CDC and WHO.
- the dangers of physical inactivity.
- costs to themselves and others of sitting too much.
- key strategies to help them prevent the dangers of sedentary behavior.
- the principles and benefits of the GUM program.

The evaluation team made an effort to develop multiple test items that would assess learners beyond the basic recall of the facts and information presented in the lesson. Therefore, many of the item types were multiple-select or choice-matrix. As a result, the team needed to create an intentional scoring system for each item, as shown in Table 1. First, each item was considered for its level of complexity and difficulty, and then assigned a score weight of one, two, or three. Because one of the matrix items could earn no less than five points in Google Forms, five points was chosen as the baseline score for all items.

Table 1

Difficulty Level and Points Awarded Per Item in Pre/Post Tests

Item #	Weight	Points	Item #	Weight	Points
1	x3	15	6	x3	15
2	x1	5	7	x2	10
3	x1	5	8	x3	15
4	x1	5	9	x1	5
5	x2	10	10	x2	10

This scoring system was integrated into the Google Form pre and post tests. However, Google Form's limited scoring abilities meant that subjects would be assigned points using an all or nothing strategy. The team felt it would be more appropriate in this case to assign partial credit for each item and designed a procedure to be done in Google Sheets manually after all data was collected and exported. First, the raw score for each item was determined. One point was awarded for each correct answer. One point was subtracted for each incorrect answer. A minimum score of zero was enforced, so no participants earned negative points for any item. Second, these raw points were converted mathematically based on the number of points the item was worth. Finally, adjusted item points were added together to determine the overall score earned by each individual participant.

Tryout Conditions

All standard participants received their participation instructions through an email. They completed the lesson components at their own convenience on their own devices. This is similar to the expected conditions of future users of the GUM program. Non-standard participants included nine subjects who participated in a usability test. As shown in Table 2, the conditions for each test were different, but all sessions were evaluated using the same observation sheet (Appendix E). Those subjects who completed the usability test were encouraged to think out loud as they worked through the items. Virtual usability tests were conducted using a Google Meet or a Zoom call where subjects shared their screen for the duration of the process. These sessions were recorded whenever possible to provide

a record and allow further review by all members of the evaluation team. Some in-person subjects also logged into Zoom or Google Meet and shared their screen for the purpose of obtaining a recording.

Table 2

Usability Test: Subject Information, Conditions, and Evaluator

Subject #	Age Range	Occupation	Conditions	Evaluator
1	19 - 40	Instructional Technologist	Virtual - recorded Google Meet	Lisa Lark
2	61+	Psychologist	In-Person - recorded Google Meet	Lisa Lark
3	19 - 40	High School Teacher	Virtual - recorded Google Meet	Lisa Lark
4	61+	Professor and Entrepreneur	Virtual - unrecorded Zoom	Mark Angel
5	61+	Shop Owner	Virtual - unrecorded Zoom	Mark Angel
6	< 18	Student	In-person - unrecorded	Mark Angel
7	61+	Retired	In-person - recorded Zoom	Maricel Manglicmot
8	61+	Supervisor	In-person - recorded Zoom	Maricel Manglicmot
9	19-40	Firmware Engineer	In-person - recorded Zoom	Maricel Manglicmot

Results

Participants' overall scores on the pre and post tests are summarized in Appendix F. Most subjects improved on their initial score after completing the lesson, as seen in the histogram (Figure 2). Additionally, the mean pre-test score was 50.83 while the post-test mean was 60.76. Overall statistical analysis results are shown in Figure 3. A directional t-test confirmed the statistical significance of this improvement with a p-value of 0.0000678. Based on this result, the team also calculated the Cohen's d

value using a pooled standard deviation. With a Cohen's d value of 0.855, the results were also shown to be practically significant.

Figure 2

Histogram Comparing Pre-test and Post-test Scores

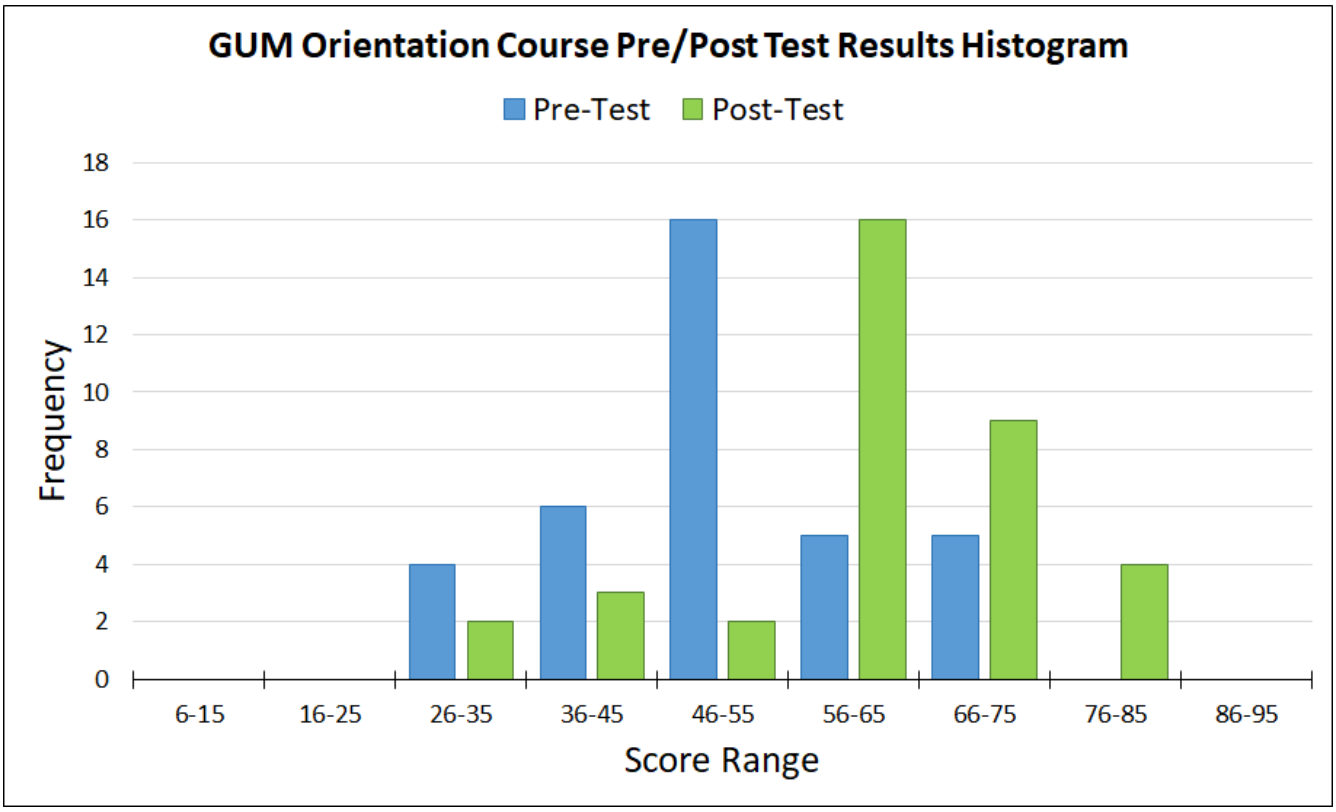

Figure 3

T-test Results and Cohen's d Calculations

t-Test: Paired Two Sample for Means

	Pre-test	*Post-test*
Mean	50.83333333	60.76027778
Variance	115.8371829	153.7610256
Observations	36	36
Pearson Correlation	0.422189249	
Hypothesized Mean Difference	0	
df	35	
t Stat	-4.754924437	
P(T<=t) one-tail	1.67801E-05	
t Critical one-tail	1.689572458	
P(T<=t) two-tail	3.35603E-05	
t Critical two-tail	2.030107928	

Cohen's d Calculations

Mean Difference:	9.926944444
Average of Variances:	134.7991042
Pooled Standard Deviation:	11.61030164
Cohen's d:	**0.85501176**

Item Analysis

In order to better understand the overall results, the evaluation team also looked at each individual item. First, raw scores were converted into percentages and averaged for each item. The difference between the post-test and the pre-test averages for each item was calculated (Figure 4). These results demonstrate that while some items showed significant improvement, others did not. For example, items three and six both showed a significant improvement from the pre-test to the post-test, while items seven and ten each showed the average score dropping by less than two percent. Table 4 summarizes additional t-tests that were completed for each item to determine which results were significant. Items three, four, five, and six were shown to have statistical significance. Cohen's d values were also calculated for the items that were not statistically significant.

Figure 4

Change from Pre-test to Post-test of Average Score for Each Item

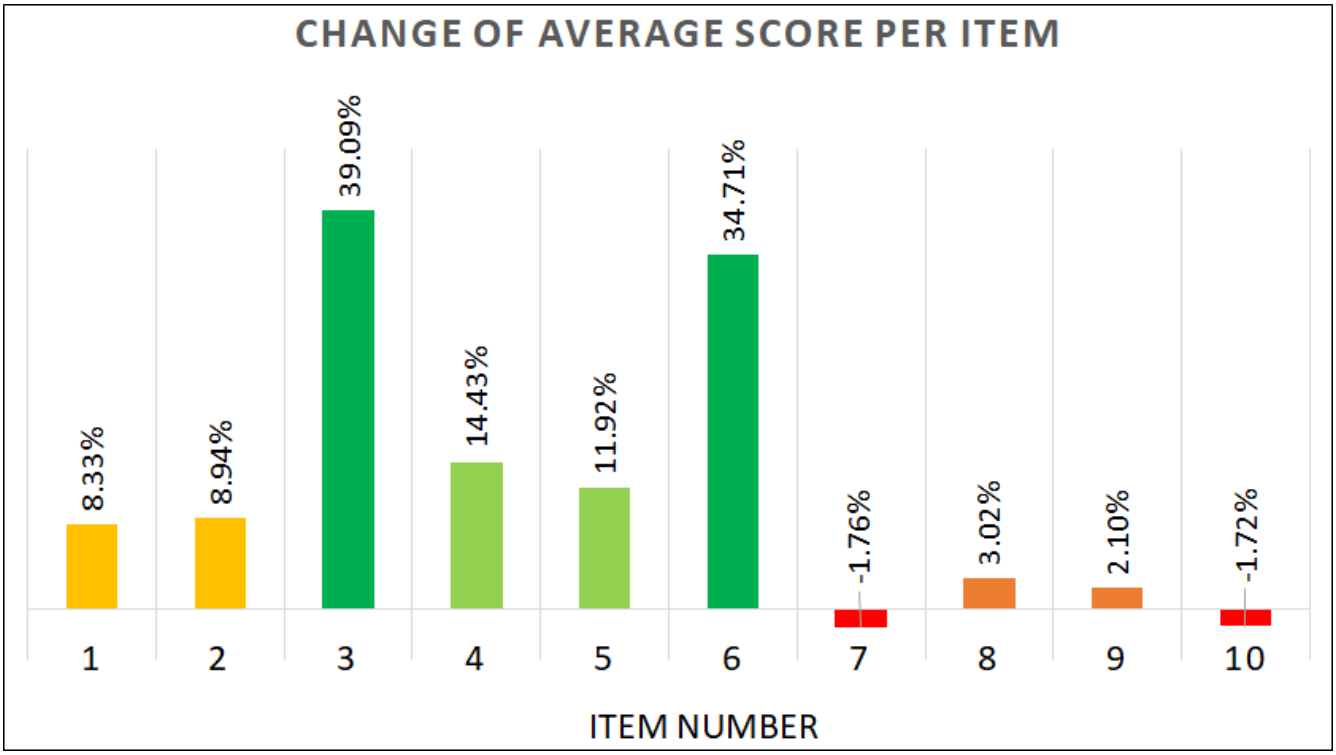

Table 4

T-test and Cohen's d Calculations for each pre/post test item

Item #	P-value (one-tail)	Cohen's d	Item #	P-value (one-tail)	Cohen's d
1	0.162087171	--	6	4.9796E-07	1.225474538
2	0.100462193	--	7	0.298552031	--
3	0.000210806	0.857750392	8	0.162087171	--
4	0.047995868	0.276682003	9	0.5	--
5	0.005752628	0.561630647	10	0.415388402	--

Questionnaire

Results from the post-test questionnaire are summarized in Table 5 with additional graphs provided in Appendix G. Overall, feedback was positive and most people agreed or strongly agreed with each statement. The questionnaire also asked two constructed response questions:

- What was something you liked about the course?
- What was something you would change?

In their answers to the first question, participants often described the multimodal nature of the course and the variety it provided on each slide as increasing their engagement and interest in the course. Many participants also liked the simple, everyday activities that were provided as solutions to help them move more in their own lives. Other common feedback showed that the course was relevant, well-paced, and provided important statistics without being heavy handed.

When it came to dislikes, the most common complaint was that some of the post-test questions were not explicitly covered within the course. The second most common feedback related to problems with inconsistent audio in some of the videos. Feedback from participants that experienced navigation or technical issues was specific to certain slides, but will help the course designer to improve the navigation experience overall. Finally, some participants felt that the topic was straight-forward enough to be presented in a simpler and shorter way.

Table 5

Reaction Questionnaire Data

Prompt	Strongly Agree	Agree	Disagree	Strongly Disagree
The course had an appealing design.	14	18	4	0
I understood how to navigate through the presentation.	21	12	3	0
The audio narration was an effective teaching tool.	24	10	2	0
The information in this course was presented clearly.	28	7	1	0
The pace of this course was appropriate.	24	10	2	0
The material was presented in an interesting way.	22	13	1	0
The material was relevant to my job.	17	11	6	2
This course changed the way I think about how much time I spend sitting.	19	11	6	0
I will change my behavior as a result of taking this course.	15	15	5	1
I would recommend this program to someone I know.	22	12	2	0

Usability Tests

The nine subjects who participated in a usability test provided a representative sample of the target audiences. For those users within the 61+ age group, we consistently observed significant issues with navigation. For example, multiple users were observed having trouble moving from slide to slide and struggling to play the videos. The interactive activities were also difficult for this age group despite the navigation video at the beginning explaining how to complete drag and drop items.

All users appreciated the overall message of the program, while some felt the course was too long. Most participants consistently wanted more information about the GUM program itself and more videos of Mark introducing various movements.

Entry conditions

Participants were expected to have fundamental computer knowledge that would allow them to problem solve and pick up new navigation controls quickly. Upon observation, subjects 61 years of age and older had difficulty navigating the course. Some did not know the concept of a play button and had problems playing videos and controlling audio. Drag and drop activities were also a challenge for this age group despite the how-to tutorial within the navigation video on Slide 2.

Participants were expected to have high English proficiency, however, some English learners struggled with understanding American colloquialisms and some vocabulary terms, such as the word "non-communicable" and "sedentary." Additionally, participants were expected to have little or no knowledge of the GUM program before taking the pre-test. Even without knowledge of GUM, participants were able to guess correctly on the items intended to assess their learning on this goal. For example, 35 out of 36 participants got question nine correct on the pre-test.

Instruction

It was expected that the entire evaluation process would take participants between 25 and 30 minutes to complete including pre/post-test portions. However, multiple subjects were observed taking much longer. This was specifically observed with participants that experienced navigation issues that slowed them down. Additionally, many subjects from the usability test were observed taking a very long time with the pre-test, even though they were expected to take between two or three minutes.

Another case of observed instruction varying from expected instruction involved the content on Slide 17 and the accompanying knowledge check on Slide 18. Observed participants demonstrated confusion trying to differentiate accurately between exercise and activity. Additionally, the knowledge check did not provide feedback, allowing misconceptions to continue.

Outcomes

Although there were many constructive criticisms of the course, there was a generally positive response. As expected, subjects overwhelmingly demonstrated that the course introduced them to novel

and vital information about how sedentary behavior affects their health. Furthermore, many also expressed that they obtained life changing value from participating in the program. This positive outcome was evidenced in the qualitative information gained from the questionnaire and usability tests. This showed more decisive positive results than the data from the quantitative pre/post-test data, which did not show as large an improvement overall as expected.

Our youngest participant (12 years old) pointed out that there may be liability issues from recommending that people use a bathroom further from their desk just to get in a bit more activity during the day.

Recommendations

Many subjects found the navigation to be confusing even with the video tutorial. One way to strengthen accessibility for all learners is to incorporate a “next” and “back” button directly on the screen instead of just using the standard navigation underneath the module. Also, including audio that explicitly directs learners to move to the next slide can remove confusion as to when and how to move forward.

The interactive activities also proved confusing to some people. The demonstration in the navigation video was insufficient as were the simple audio instructions to “drag and drop” items on the screen. To remedy this, explicitly written instructions specific to each activity should be added directly to the corresponding slides.

Because of challenges observed during two usability tests, additional accessibility improvements are needed to better support English Language Learners. For example, the course could clearly define “sedentary” and other key terms on slides where they are first introduced. Should the learner need clarification on other terms, a dialogue box could be designed to pop up showing the definition when a mouse hovers over the word. Avoiding colloquialism can also minimize obfuscation for English learners.

Results from the pre and post tests identified a knowledge gap that can be filled by restructuring course content. Problems with item eight showed that participants remained unclear about strategies to increase activity. This and other content can be better supported by adding more direct instruction such as a graphic showing various activities like those in the question and their relative effectiveness at breaking up sedentary behavior.

Finally, some subjects mentioned that they would have preferred a simpler and shorter lesson to convey the same information. Creating a new 5-10 minute instructional video to cover the same content in various ways could be effective. Not only would this be easier to navigate for older participants, but it would also allow GUM's creator, Mark Angel, to leverage his expertise and passion. Some participants commented that their favorite parts of the lesson were Mark's custom videos. They appreciated the personalization and wanted more information about the GUM program to be included in the lesson. One participant also emphasized the ease with which people can share videos online with their friends, allowing the Get Up and Move message to reach more people.

Conclusion

The goal of the GUM program is to transform the way participants perceive their own habitual sedentary behavior and how it affects their lives. Analysis of the pre and post test data showed that significant learning took place with respect to key target objectives as a result of taking the course. Confidence in the data was bolstered by the strong turnout of participants with 36 completing the entire process. Challenges with navigation in general made it difficult and time consuming for some participants to complete the process, especially those in the oldest age group.

Subjective accounts from the questionnaire and participants' additional self-reporting showed overwhelmingly that subjects responded positively to the program and found it helpful and edifying. Even without prompting, some participants were inspired to get up and move during the course itself. Participants tended to express enjoyment and engagement throughout the program, saying that the

multi-modal presentation held their attention and conveyed valuable information, although some felt it could have been done in a more direct and concise way. Finally, several participants stated outright that they were going to change their sedentary ways as a direct result of taking this course.

It is clearly evident that people spend too much time sitting and reclining, and that these sedentary behaviors have significant deleterious effects on health. Because they have less choice in the matter, this is especially egregious with respect to people who are required to spend hours sitting at their desks for their work or school. In order to get people to upend their sedentary behavior, it is helpful to clearly inform them of the dangers of sitting too much in ways that sink in. It is crucial not only to show them alternatives and provide goal-setting opportunities and self-monitoring systems, but also to provide them with work-place and school environments that are conducive to standing and moving more.

Research data also show the value of the motivational information and encouraging physical activity throughout the workday. And by incorporating light activity into otherwise sedentary routines, sedentary behavior can be substantially reduced (Rovniak et al., 2014; Steeves et al., 2012). Furthermore, it would be beneficial if employers not only educate desk-workers about the benefits of moving more and standing at their desk, but enable them to do so by providing standing desks, social support, and work environments conducive to periodic light to moderate physical activity.

The Get Up and Move project is intended to reach out to as many people as possible. Often, people do not even realize that their workplace or lifestyle results in an excess of sedentary behavior. For instance, someone who exercises regularly, even more than recommended by the WHO and CDC, may still be considered sedentary if they sit for long periods of time between exercise. The key to overcoming a sedentary work or life situation is to move regularly throughout the day, regardless of one's total activity time in any given day or week. This is because much of the damage caused by being sedentary occurs in the body while sitting for long periods of time—over an hour, or for more than a

total of four hours a day. The damaging biochemical reactions in the sedentary body often are not fully reversed by exercise, however, the damage is prevented when one is physically active frequently throughout the day. A particular caution is advised for those who think they are optimally healthy and yet they still sit for extended periods in any given day; and also, for those who do not exercise regularly, or at all.

By using the Get Up and Move website or the GUM app, people can be more mobile throughout the day and thereby avoid the dangers of sedentary behavior altogether.

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Appendix A

For the Get Up and Move (GUM) Orientation Course (revised after evaluation), please see the link on the landing page of the website:

www.getupandmove.net

Appendix B

Initial Solicitation of Subjects

Dear Friends and (Neighbors/Colleagues):

I am working towards a Masters Degree in Instructional Science and Technology (MIST) at California State University, Monterey Bay. My team of three master's students needs data from a minimum of 20 subjects who will test a short instructional program and provide feedback on their experience. This program is part of the requirements for a summer course focused on instructional evaluation.

First, we will be asking participants to take a pre-test, and then complete a short informational course called Get Up and Move (GUM). Finally, participants will take a post-test and give feedback on their experience. Allow 25-30 minutes to complete this process.

Thank you for considering participation in the evaluation of the GUM health and wellness program. Developed by team member Mark Angel for his Capstone project, GUM is aimed at getting people to stand and move more throughout the day. Your feedback at this time will provide all team members with valuable experience that will be applied to their own Capstone projects this fall.

If you are available to participate in this study, please click this link and begin the Pre-test. All data must be collected by July 19th so prompt replies are appreciated. Feel free to pass this along to others you think will benefit from this program and may be interested and available.

Sincerely,

Email to Data Subjects Who Responded

Hi [NAME],

Thank you for agreeing to help us test the efficacy of our Get Up and Move Orientation Course. Please allow 25-30 minutes to complete steps 1-3 below.

1. Follow this link to complete the Pre-test.
2. You will be provided with the course link at the end of the Pre-test.
3. The Post-test link will be provided at the end of the course.

If you have any questions or problems while attempting to complete this process, please contact me and I will help you resolve the issue as soon as possible.

Sincerely,

Appendix C

The following Google Form includes a copy of the pre-test used. All restrictions have been removed to allow reviewers full access. The version used in the evaluation collected e-mail addresses and required participants to answer all questions before moving on. In order to see the final message and the link provided, click the submit button at the end.

https://forms.gle/VpaJeNgmJhf26uDC7

Appendix D

The following Google Form includes a copy of the post-test used. All restrictions have been removed to allow reviewers full access. The version used in the evaluation collected e-mail addresses and required participants to answer all questions before moving on. In order to see the final message and the link provided, click the submit button at the end.

https://forms.gle/1sr243rMxnYBxRJ38

Appendix E

Observation Sheet (Front)

Tester's Name:

Participant Information:	**YES**	**NO**	***Name:*** ***Occupation:*** ***Age:*** ☐ **<18** ☐ **19-40** ☐ **41-60** ☐ **61+**
Did the user listen to all audio all the way through?			☐ User jumped around a lot ☐ Used transcript multiple times
Did the user complete all interactive elements?			
Did the user encounter any problems? (technical, navigation, understanding instructions, etc.)			☐ User resolved problem on their own ☐ User needed intervention to solve
Does the user navigate the course intuitively?			
Pre / Post Test Notes:			

Observation Sheet (Back)

Environmental Conditions during test:

Interview/Debrief Questions:

1. Ask for elaboration on any problems noted above.

2. What were your general impressions of the course?

3. Do you have any questions for me about the course, the program, or this process?

Other Notes:

Script for Usability Test

Hi (Name),

Thank you for agreeing to help us test the efficacy and usability of our Get Up and Move Orientation Course.

I am going to be observing you as you go through this process. As you go through this process, please "think out loud" as you go through all aspects of the program. If you think something is weird, silly, confusing, annoying, distracting, you don't know what to do or where to click etc., say it out loud. It will not offend me; the goal today is to improve our course and this is just our first draft.

I will also be recording this session to make sure I capture all issues that come up and share these issues with my team. Please allow 25-30 minutes to complete steps 1-3 below.

- Follow this link to complete the Pre-test.
- You will be provided with the course link at the end of the Pre-test.
- The Post-test link will be provided at the end of the course.

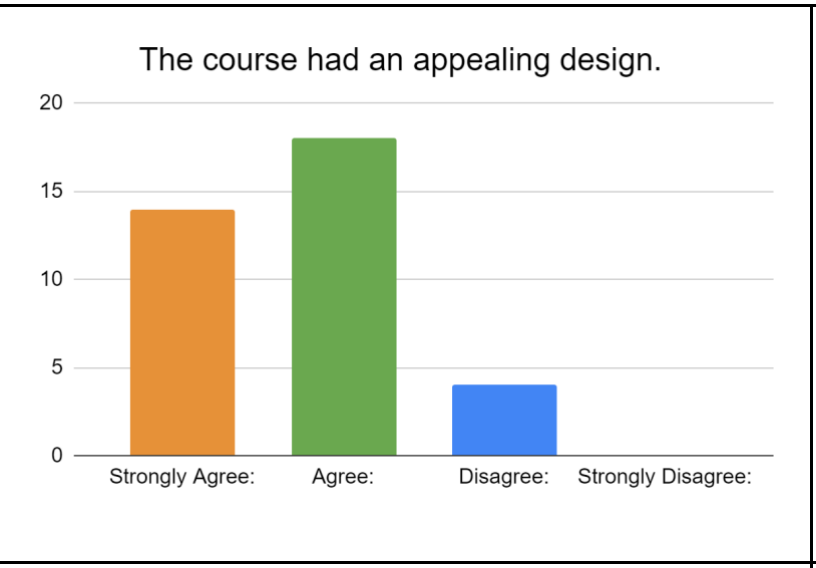
Appendix F

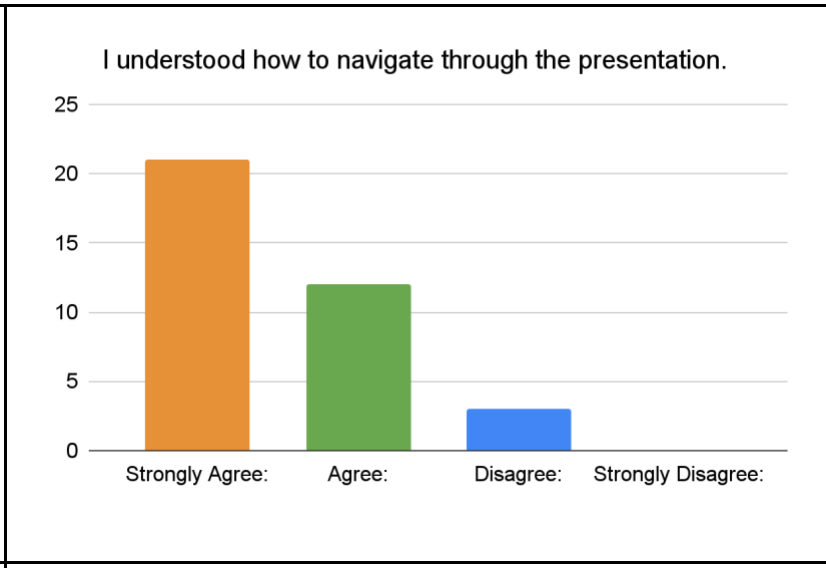
GUM Orientation Course: Pre-test and Post-test Results

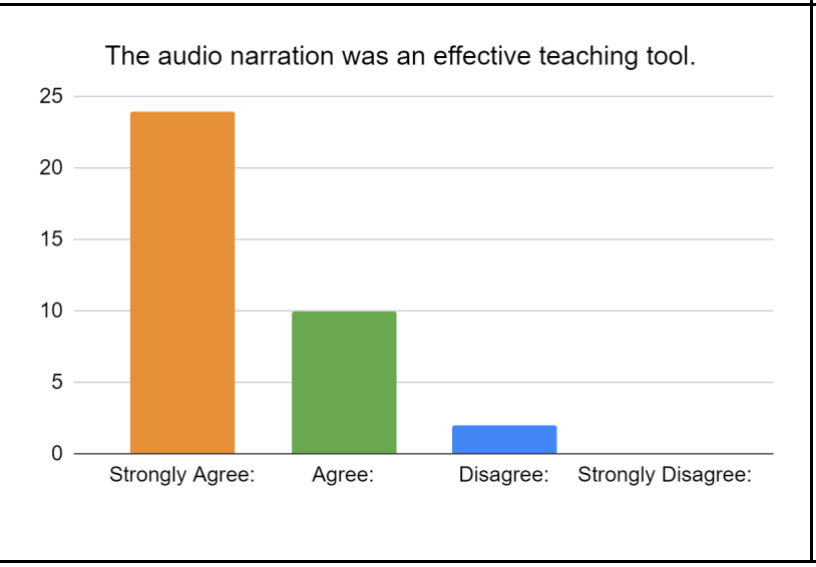
Subject #	Pre-Test	Post-Test	Delta	Subject #	Pre-Test	Post-Test	Delta
1	55.17	57.17	2.00	19	52.17	39.67	-12.50
2	58.83	76.67	17.84	20	49.83	66.5	16.67
3	45.17	57.17	12.00	21	54.83	68	13.17
4	52.17	62.17	10.00	22	49.83	69	19.17
5	54	60.17	6.17	23	28.5	73.17	44.67
6	62.33	56.83	-5.50	24	53.83	69.67	15.84
7	66.67	69.67	3.00	25	44.67	68	23.33
8	52.17	72.67	20.50	26	45.83	58.33	12.50
9	39.5	61.83	22.33	27	43.17	73	29.83
10	52.33	79.67	27.34	28	54.17	55.5	1.33
11	65.67	76.5	10.83	29	45	61.83	16.83
12	49.83	61.5	11.67	30	65.17	59.17	-6.00
13	26.5	48.17	21.67	31	48.5	60.5	12.00
14	54.17	58	3.83	32	36.33	42.5	6.17
15	34.33	34.33	0.00	33	70.17	83	12.83
16	61.5	64.17	2.67	34	34.33	38	3.67
17	51.33	31.67	-19.66	35	63	57.17	-5.83
18	66	64.67	-1.33	36	43	51.33	8.33

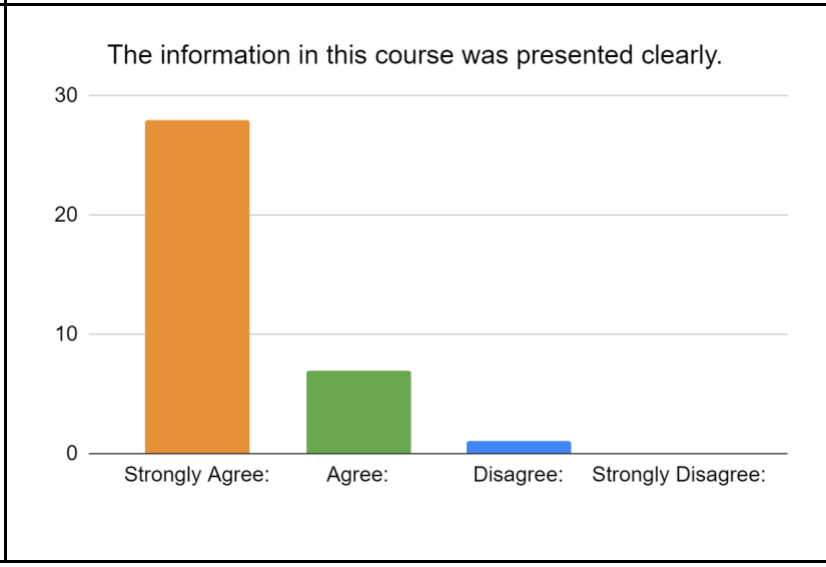
Appendix G

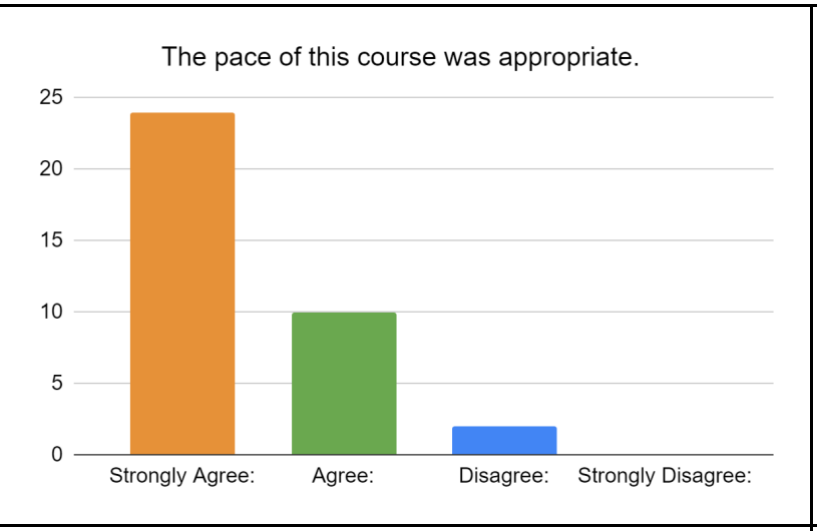
Questionnaire Results

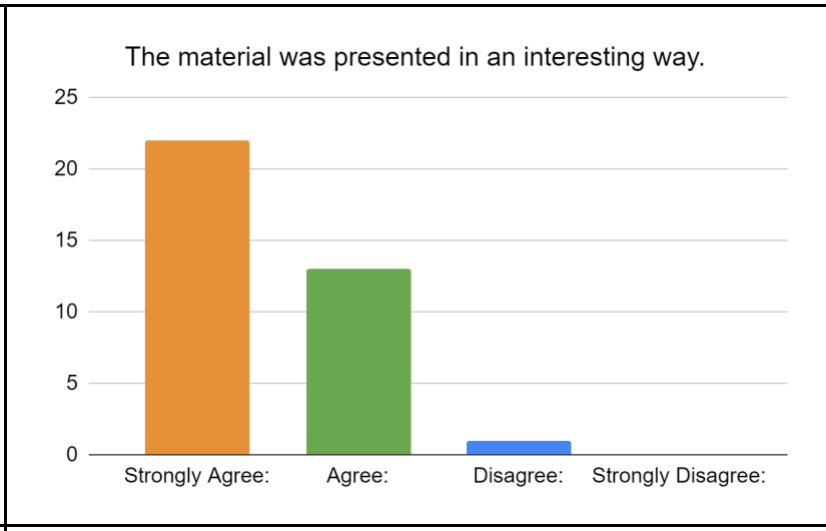


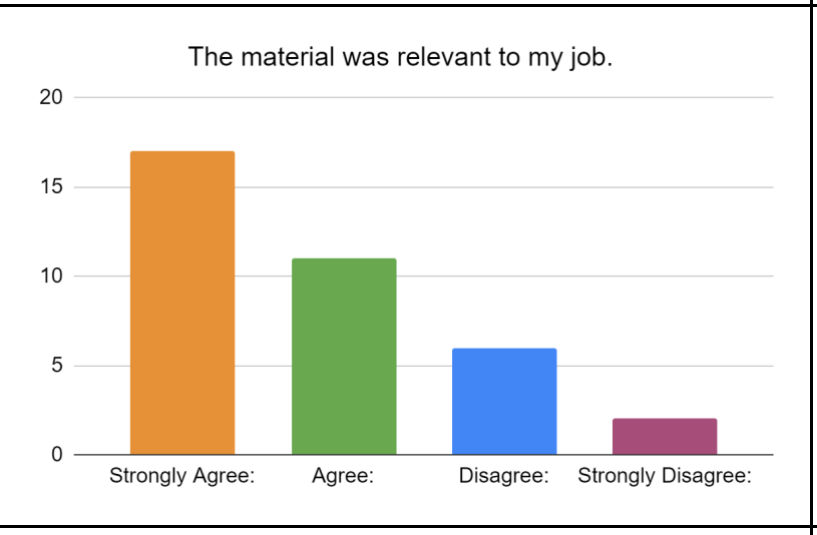


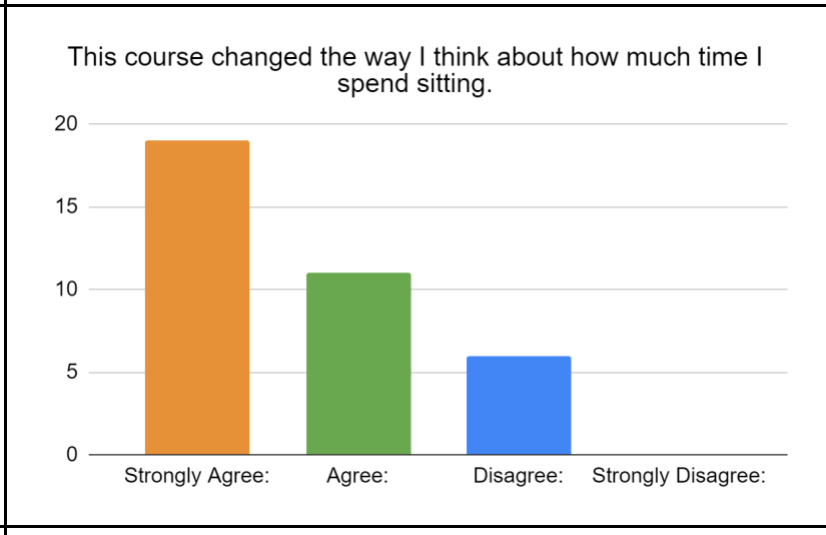


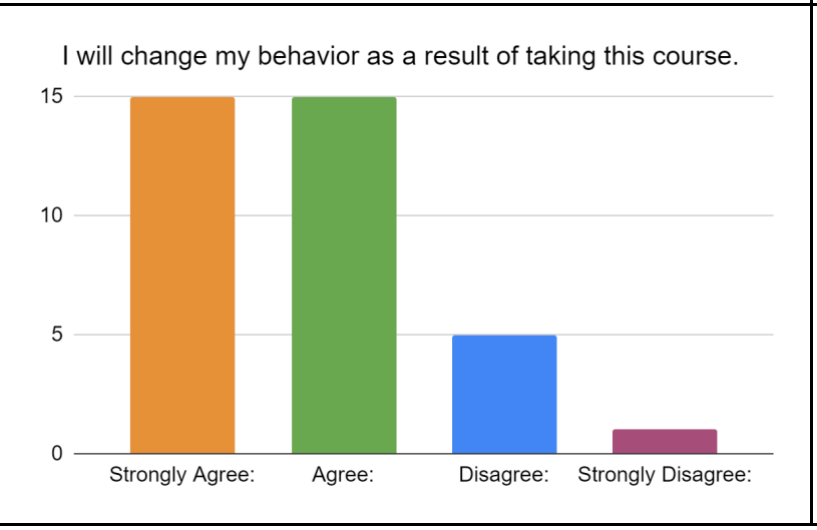


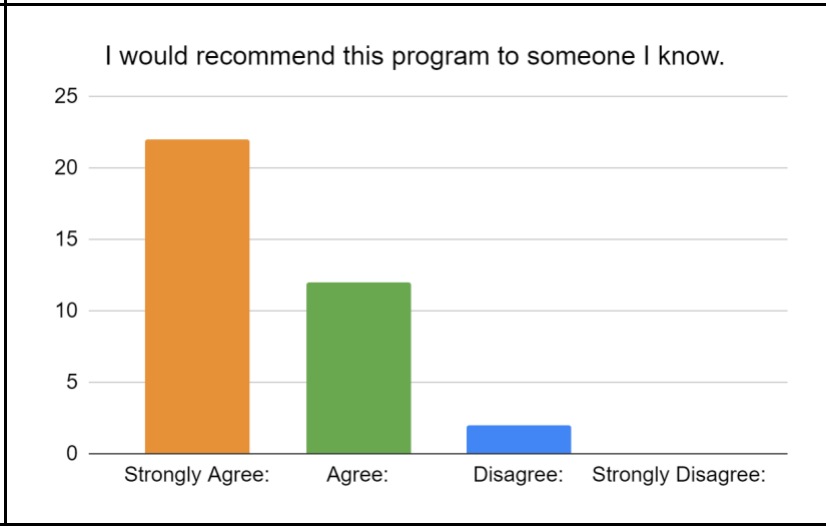

The pace of this course was appropriate.
25
20
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree:


The material was presented in an interesting way.
25
20
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree:


The material was relevant to my job.
20
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree:


This course changed the way I think about how much time I spend sitting.
20
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree:


I will change my behavior as a result of taking this course.
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree:


I would recommend this program to someone I know.
25
20
15
10
5
0
Strongly Agree:
Agree:
Disagree:
Strongly Disagree: