UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Active Study Stations: Assessing Student Awareness and Perceived Effectiveness

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EXECUTIVE SUMMARY

The aim of our research was to explore the awareness of active study stations amongst UBC students. The active study stations are a part of UBC's SEEDS campaign that looks to provide students with alternative study spaces. Not only does this initiative "provide a direct way to enhance learning for UBC students" (Moorhouse, 2018, para 1), but it also helps to enforce UBC's priorities that are focused on healthy active living and well-being (Moorhouse, 2018). Though we understand the positive health implications that the active study stations may have on the well-being of UBC students, we wanted to explore first-hand if students were aware of the benefits of this campaign, as well as their opinions on them.

To begin, we collected data by asking students to complete a survey assessing various factors associated with the active study stations at UBC. The survey questions included topics such as demographics, current physical activity levels, sedentary behaviour, and awareness/use of active study stations. Surveys were then distributed online via social media as well as in-person on campus. In-person strategies included the distribution of posters and flyers in common areas, like UBC Nest, UBC Life Building, and Irving K. Barber Learning Center. After collecting the data, we gathered the information and assessed using predominantly quantitative measures, however some qualitative measures were included.

The data showed that we had 84 respondents overall, with the majority of them being 4th year undergraduate students. The dominant faculties that the respondents were from were Business, Kinesiology, and Science. The data showed that most students were not meeting the required 150 minutes of moderate to vigorous physical activity per week. Additionally, most students showed that they were engaging in around 6-7 or more hours of sedentary behaviour per day. In regard to the active study stations, around 50% of respondents reported that they were aware or have seen the active study stations at UBC. However, only 20% of those respondents said that they have used the active study stations before. Data was also collected in order to evaluate why or why not students were encouraged to use the active study stations. We used the Health Belief Model to guide our data analyses. Limitations were identified at the end of the research. This touches on factors such as selection bias, respondent variation, and recruitment difficulties.

Lastly, recommendations were made in order to apply our data for further research and policy decisions. These include: initiating a rewards program for students to encourage the use of active study stations, installing more active study stations in popular UBC libraries, physical upgrades of the active study stations, and implementing further educational strategies on active study stations. We hope that with our collected data and recommendations, that we can instill new study norms that involve and encourage physical activity for UBC students.

INTRODUCTION AND LITERATURE REVIEW

According to epidemiological evidence, approximately 20% of premature deaths can be prevented through physical activity (Katzmarzyk, Gledhill, & Shephard, 2000). Furthermore, evidence suggests that physical activity is a simple and effective preventative measure that reduces the risks for over 25 chronic conditions (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). Despite these statistics, researchers found that 72.2% of undergraduate students across 8 Canadian post-secondary campuses were classified as physically inactive and engaged in less than 4 days of moderate to vigorous physical activity (MVPA) (Kwan, Faulkner, Arbour-Nicitopoulos & Cairney, 2013; Trembley et al., 2011). While engagement in physical activity tends to decline with age, evidence shows a disproportionate decline in physical activity during the critical transition from late adolescence to early adulthood (Zick, Smith Brown, Fan, & Kowaleski-Jones, 2007). Notably, it is unclear if physical activity counteracts the negative effects of sedentary behaviour (Tremblay, Colley, Saunders, Healy & Owen, 2010). However, highly active students who are meeting the physical activity guidelines are still at risk of developing chronic diseases because of the working and learning university life that is associated with sedentary behaviour (Hamilton, Hamilton & Zderic, 2007).

In the recent 2018 Undergraduate Experience Survey at the University of British Columbia (UBC), 45% of the respondents were not meeting the recommended 150 minutes of MVPA per week (UBC wellbeing, n.d; Trembley et al., 2011). It is imperative that universities take action to help students adopt an active lifestyle as it can result in enhanced physical and mental wellbeing (Darren, Warburton, Katzmarzyk, Rhodes & Shepard, 2007; Mandolesi et al., 2018). Therefore, in order to help students, incorporate

more physical activity into their lives, UBC has implemented active study stations in Irving K. Barber Learning Center (IKBLC). Active study stations can include modified desks that help keep students moving while studying (Bastien Tardif, Cantin, Sénécal, Léger, Labonté-Lemoyne, Begon, and Mathieu, 2018). Some examples include standing desks and pedal desks (PDs) (Bastien Tardif et al., 2018). Further, the objective of this literature review is to illustrate the importance of physical activity to students' overall health. Additionally, it will explore the current research on active study stations, particularly PDs, and their impact on student's everyday campus life.

Health Consequences of Sedentary Behaviour

Sedentary behaviour (SB) is classified as sitting for periods of time where the body is at a low energy expenditure (Owen, Healy, Matthews & Dunstan, 2010). There are several health concerns that are associated with SB; including: mortality, cardiovascular disease, Type 2 diabetes, musculoskeletal disorders, and obesity (Rezende, Lopes, Rey-Lopez, Matsudo & Carmo Luiz, 2014). Consistent findings suggest that cardiovascular disease and all-cause mortality are associated with SB, regardless of one's body mass index and level of physical activity (Rezende et al., 2014). In other words, statistics show that for every two hours of additional sitting time, there is a 5% and a 13% increase in cardiovascular disease and all-cause mortality, respectively (Rezende et al., 2014). Additionally, results from previous studies showed that groups with the most sitting time were at a significantly higher risk of mortality in comparison to a reference group (Katzmarzyk, Church, Craig & Bouchard, 2009). Similarly, studies conclude a positive association between SB of two or more hours of sitting time per day with cardiovascular disease and Type 2 diabetes, regardless of the level of physical activity (Rezende et al.,

2014). Physiological effects of SB on the human body is an area that requires additional research (Katzmarzyk et al., 2009). However, potential mechanisms, including activity restriction, causes changes to cardiac output, stroke volume, and glucose tolerance (Katzmarzyk et al., 2009). Specifically, this refers to the differential effects caused by SB on lipoprotein lipase activity in tissues (Katzmarzyk et al., 2009).

Health Benefits of Physical Activity

Physical activity has many benefits that range from improving mental health to physical health (Sng, Frith, & Loprinzi, 2018; Stroth, Hill, Spitzer & Reinhardt, 2006). Furthermore, these benefits will allow students to be more successful during their university career and also throughout life (Sng, Frith, & Loprinzi, 2018; Stroth, Hill, Spitzer & Reinhardt, 2006)

Cognitive benefits will improve student's grades, study habits, and mental health (Mandolesi, Polverino, Montouri, Foti, Ferriaioli, Sorrentino, & Giuseppe, 2018; Sng, Frith, & Loprinzi, 2018; Stroth, Hill, Spitzer & Reinhardt, 2006). In Sng, Frith, and Loprinzi's study (2018), students who were physically active before learning showed better short term and long memory than students who did not exercise before learning. This increase in memory may allow students to retain more information during class or during study sessions. In a study focused on the benefits of aerobic endurance exercise on memory in young adults, aerobically fit students showed better results when tested on learning attention (Stroth, Hill, Spitzer & Reinhardt, 2006). The same aerobically fit students also had increased mood and higher cognitive functioning (Stroth et al., 2006). Taking part in physical exercise also improved mental health as those who exercised regularly were less depressed and anxious in comparison to those who did not (Mandolesi et al., 2018).

University Initiatives

UBC Okanagan was the first UBC campus to begin their initiative to implement treadmill desks and bicycle desks (Hamilton, Foster, & Potter, 2018). Over the span of 10 years, The VOICE research team collected longitudinal data on campus from students regarding their typical physical activity habits (Hamilton, Foster, & Potter, 2018). Results from this longitudinal study demonstrated that there is a need to prioritize student health (Hamilton, Foster, & Potter, 2018). In response to the study, VOICE began their initiatives to research active study stations (Hamilton, Foster, & Potter, 2018). In 2016, the treadmill desk was first integrated into UBC Okanagan's library, followed by bicycle desks the year after (Hamilton, Foster, & Potter, 2018). To measure the effectiveness of the study stations, participants within the study were sent a survey link where they were asked to evaluate their experience (Hamilton, Foster, & Potter, 2018). Results of this study indicated that the treadmill desk was used for longer periods of time (40.53 minutes) compared to the bike desks (23.3 minutes); though the frequency of students picking either desk was about 50/50 (Hamilton, Foster, & Potter, 2018). Overall, students "agreed" or "strongly agreed" that they experienced reduced feelings of anxiety, improved focus and physical relief in back and joint pain (Hamilton, Foster, & Potter, 2018). Notably, students expressed that they would have enjoyed the study station to be more private or located in a smaller room (Hamilton, Foster, & Potter, 2018).

Current Research

Overall, research remains inconclusive to the benefits of sit-stand desks - SSD's (Finch, Tomiyama, & Ward, 2017). A sit-stand desk is an electronically adjustable desk that can be adjusted to the appropriate height for standing or sitting (Finch, Tomiyama, &

Ward, 2017). A 2017 study shows that SSD's for a short-term standing period, do not hinder or affect cognitive performance, nor show significant differences in comparison to sitting desks (Finch, Tomiyama, & Ward, 2017). However, in regards to mood, participants expressed increases in interest, enthusiasm, and alertness during certain reading tasks (Finch, Tomiyama, & Ward, 2017). Despite the results, it is important to highlight the non-intrusive nature SSD's have on cognitive and studying performance. This indicates that SSD's can still decrease sitting time regardless of its performance effects. Similar studies done on treadmill desks (Dutta, Koepp, Stovitz, Levine & Pereira, 2014), and on bike desks (Torbeyns, De Gues, Bailey, De Pauw, Decroix, Van Custem, & Meeusen, 2016) also show no impairment or intrusion towards cognitive or mechanical performance - such as typing performance. In the 2016 study, positive effects for the bike desks were shown to have an improvement across tasks that require intense cognitive attention and inhibition. This was concluded to contribute to an improved work environment (Torbeyns et al., 2016). Overall, additional replication studies should be conducted to determine the validity of these results (Finch, Tomiyama, & Ward, 2017)

Purpose for our Research

Although certain health benefits are dependent on the type of physical activity, such as aerobic or anaerobic activity, all sources of exercise yield benefits. Based on empirical evidence, regular physical activity maintains healthy body weight, strengthens bones, and improves well-being (ParticipACTION, 2019). While there have been ample amounts of research done on the benefits of active study stations in a university setting (Bastien Tardif et al., 2018; Hamilton, Foster & Potter, 2018), consideration of the possible limitations of active study stations must be noted. For example, researchers have

observed that students may experience difficulties with trying to balance the tasks of studying and the physical demands of the active study stations (Hamilton, Foster & Potter, 2018; Tardif et al., 2018). Further, students may result in feeling self-conscious of doing so while being in a public space, such as the library, due the unconventionality of active study stations (Hamilton et al. 2018). With this in mind, there should be a focus on how students perceive active study stations. Further, measures should be taken to understand how student's perceptions of active study stations may affect their levels of physical activity and SB.

Therefore, the purpose of this research is to evaluate the student's awareness of UBC's current active study stations. Additionally, measures will be taken to evaluate how student's beliefs about SB will either encourage or hinder their use of active study stations.

METHODS AND RATIONALE

Target Population

The target population for this study are all students at UBC. Health interventions should be made a priority for this population as a substantial amount of evidence suggests that individuals entering university often adopt risky health behaviours, such as alcohol consumption (Bewick et al., 2008), cannabis use (Lee et al., 2013), poor diet and eating patterns (Dodd et al., 2010), and low levels of physical activity (Greene et al, 2011). The adoption of unhealthy behaviour can be due to stressors associated with student experience, such as academic commitments (Pryimachuck & Richards, 2007), financial pressures (Stixrud, 2012) and changes in social environment (Borsari, Murphy & Barnett, 2007). While the engagement in most risky health behaviours declined or plateaus by

early adulthood, the lack of physical activity does not revert itself and continues to decline with time (Kwan, Cairney, Faulkner & Pullenayegum, 2011). Findings in a longitudinal study by Kwan and colleagues (2011) demonstrate how physical activity from late adolescence to early adulthood represents the most dramatic decline in physical activity in a person's lifetime. Furthermore, the correlation between high levels of stress with risky healthy behaviours such as smoking, and alcohol-use highlights the need for more adaptive coping methods, like physical activity (Timmins, Corroun, Bryne & Mooney, 2011). With 45% of UBC undergraduate students not meeting the recommended 150 minutes of MVPA per week (UBC wellbeing, n.d), it is critical that physical activity interventions be implemented to reduce students' reliance on maladaptive coping methods. An example of physical activity interventions that could be implemented would be the use of active study stations such as PDs. Currently, the active study station installation at IKBLC consists of two stationary desks with an adjustable height desk (Moorhouse, 2018) Refer to Figure 1a and 1b for photos of the PDs at IKBLC. Coincidentally, university is a critical time period as lifestyle behaviours established in university will persist into later adulthood (Bell & Lee, 2006). This makes university students an effective target population as any health behavioural intervention will likely have lasting lifetime effects.

Figure 1a - Pedal desks at IBKLC

Figure1b - Pedal desks at IBKLC

Recruitment Procedure

It was our goal to receive diverse feedback to reflect our unique student population. Therefore, we hoped to collect data where we can reach many students from various faculties to create the best action to promote active study stations.

Originally, surveys were supposed to be collected in-person where we approached students and asked them to complete the survey using our laptops and also through social media. Unfortunately, amidst the COVID-19 pandemic, using our personal laptops to conduct surveys was no longer feasible and safe to conduct. Therefore, in-person surveys were not collected. Fortunately, online surveys were still collected. Majority of the respondents said they used our link through social media which was shared via Facebook. We also printed posters and flyers with QR codes which linked to our study. Flyers and posters were posted in IKBLC, the Student Life Building and the AMS Nest. These central hubs represent UBC's diverse student population with no specific target or bias towards certain faculties. Survey posters and slips were placed in these buildings because they are high traffic areas with a large amount of seating and food chains. We expected students to use these locations as meeting areas for groups and friends to congregate and share meals together.

The only inclusion criteria for our survey was that participants must be a student currently attending UBC. After the demographic portion of the survey, participants would be redirected to a specific set of questions tailored to their individual experience with pedal desks. For example, participants who have used the PDs will be directed to a set of questions to assess their experience while participants who have not used PDs will be directed to a different set of questions. The questions specifically evaluated individuals'

experience and perceptions of the PDs component of the active study station installation. The goal of the surveys is to evaluate individuals' experience with PDs and gain greater understanding of students' rationale to use or not use pedal desks.

In our efforts to increase our survey responses we gave respondents an incentive. Each student who completes the survey was entered into a draw for prizes including two $25 gift cards and two yoga mats.

Survey & Analysis

In total, the survey had 84 respondents who met our inclusion criteria of providing their consent to being included in the study and being a UBC student. More than 60% of our respondents had heard about our survey through social media and the rest of the respondents heard of our survey through flyers, in-person, or other ways (See Figure 2)

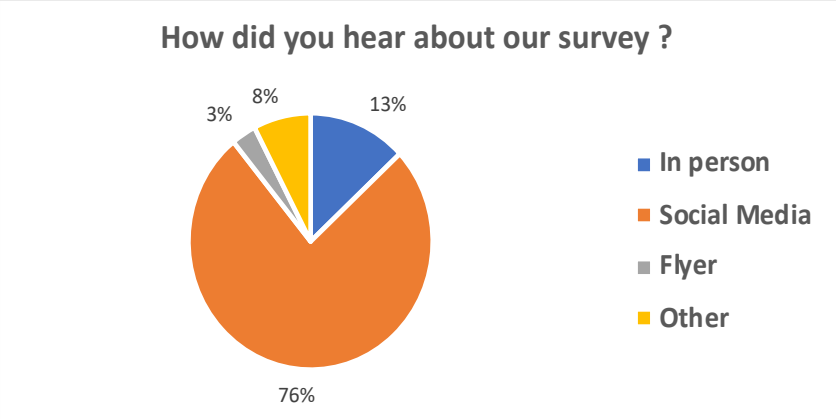

Figure 2 - Participants' response to question: How did you hear about our survey?

Online surveys were used to collect data regarding active study stations. Specifically, the survey aims to primarily collect quantitative data through a series of questions answered by a Likert scale, which uses a scale of answers including: (a) strongly agree, (b) agree, neither agree or disagree, disagree and strongly disagree (Emerson, 2017). In addition, the questions included on the survey are divided into three themes which are: demographic, awareness, and effectiveness. Demographic questions

seek to answer questions related to academic year, faculty of the subject, sex, physical activity levels, etc. of the subjects (See Table 1 for survey questions). Awareness questions are directed to the active study stations available at UBC and furthermore, the subject's knowledge or experience with the active study stations (See Table 1 for survey questions). Lastly, effectiveness questions aim to better understand the positives and negatives beliefs regarding the current active study stations (See Table 1 for survey questions). Specifically, how effective they are, how comfortable the subject is with using active study stations, and for nonusers, what deters individuals from using active study stations (Hamilton, Foster & Potter, 2018). The reasoning behind selecting surveys as the main data collection tool is due to accessibility of larger samples and time-efficacy and convenience (Minnaar & Heystek, 2013). Furthermore, we are able to collect quantitative data regarding the awareness and effectiveness of UBC's active study stations across a sample of students from different faculties and years, to better understand active study stations at UBC as a whole. Once we received the survey responses, we exported the data for further analyzing and interpreting. As each question pertains to a variable regarding demographic, awareness, and effectiveness information, relevant data from each measurement category will be presented using graphs.

Table 1

Participants' responses to question: What would motivate you to use the pedal bike?

- More comfortable looking seats
- More locations, rewards
- I would love to use it if there was a reward involved
- If I am studying with friends or just to try it out
- Some sort of physical reward or incentive.
- Nothing, multitasking just decreases the efficiency of both tasks, I would finish my work and get a good workout in a shorter time than trying to study with this desk.
- Not interested, I feel like instead of pedaling I would rather gym and then focus on my studies after
- Not much. Can't focus while on it
- Nothing, I don't find it worth the discomfort
- I am not sure its distracting when I study, if I want to go gym then I'll go gym and take a break that way
- Nothing really - I don't think I'd ever use it
- installed in different libraries
- nothing, nothing, nothing

RESULTS AND FINDINGS

General Study Habits and Study Preferences

Overall, most students reported taking study breaks "every hour" (52.38%), while other students said they "never" take study breaks (1.19%). Others responded that they took breaks every "half an hour" (25.00%), "every 2 hours" (19.05%) or "I never study" (2.38%) (Refer to Figure 3). From participant data, students reported that study break activities were sedentary (82.13%). "Browsing social media" (28.17%) and "eating" (26.19%), were

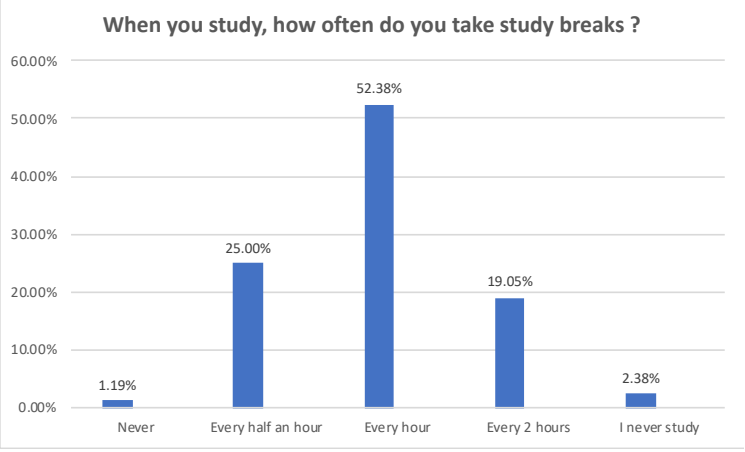

Figure 3 - Participants response to question: When you study, how often do you take study breaks?

the most frequently done study break activities. Other sedentary activities include “video gaming” (2.38%), “watching YouTube” (17.06%), “watching cable TV or TV streaming services” (8.33%). Physically active study breaks were infrequently done as only 11.11% of participants reported doing either “structured exercise at a facility” (6.35%) or “leisure exercise” (4.76%) (Refer to Figure 4).

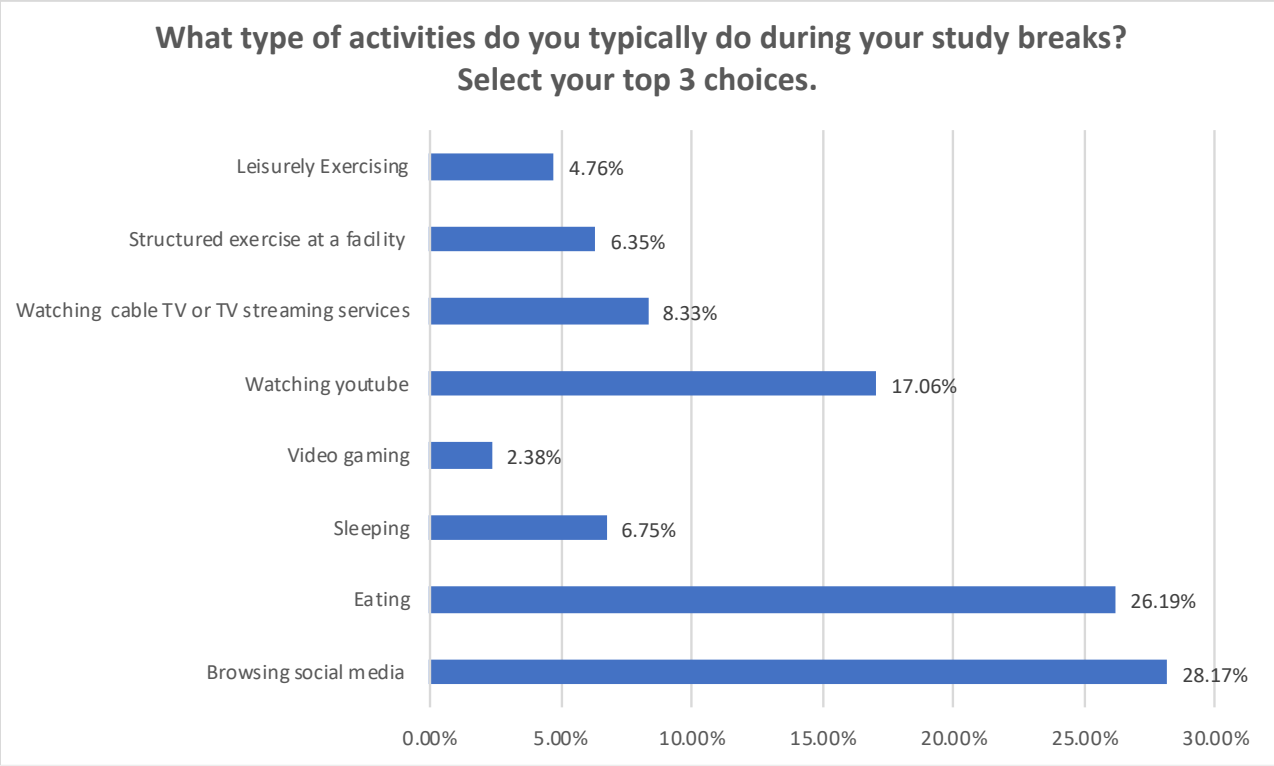

Figure 4 - Participants' response to question: What type of activities do you typically do during your study breaks? Select your top 3 choices.

Qualitative data demonstrated that certain students prefer to keep studying and physical activity separate as it is uncomfortable and distracting to their studies. 4 student responses similarly reflected one another, as they all agreed they did not enjoy the concept of combining their sedentary study time with cycling.

One student stated,

> *"…*multitasking just decreases the efficiency of both tasks, I would finish my work and get a good workout in a shorter time than trying to study with this desk" (Refer to Table 1)

Likewise, the other students said *"… it's distracting when I study, if I want to go gym then i'll go gym and take a break that way"*. Additionally, two other student responses said *"I don't like mixing cardio with studying"*, and *"I just don't want to ride a bike while I study"* (Refer to Table 1). All these responses display a strong dislike for the PD concept and therefore suggests that these types of students are unlikely to use them.

Students Awareness and likelihood to use PDs

At the beginning portion of the survey, participants were asked if they have heard or seen about the PD installation in IKBLC prior to the survey. Participants who responded "yes" (n=41, 48.81%) were categorized either into current users or nonusers (Refer to Figure 5). Current users (n=8) are defined as participants who knew about the PD installation and have used the PDs prior to participating in the survey. Nonusers (n=33) are defined as participants who knew about the PD installation before but have not used it. Participants who responded that they were

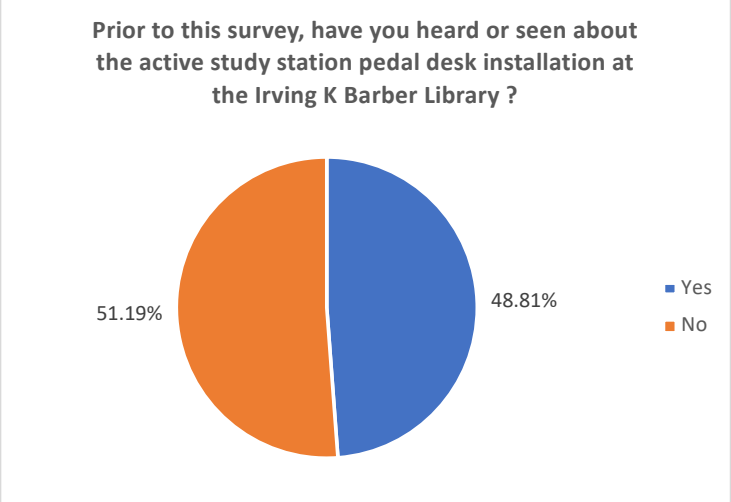

Figure 5 - Participants' response to question: Prior to this survey, have you heard or seen about the active study station pedal desk installation at the Irving K Barber Library?

unaware of the active study station installation (n= 43, 51.19%) are further categorized into either “potential nonuser” or “potential users” (Refer to Figure 5). Potential nonusers are defined as participants who were unaware of the active study stations and do not plan to use them in the future (n=13, 30.23%). Potential users are defined as participants who were unaware of the active study station but now would be willing to try the PD (n=30, 69.77%) after learning about it.

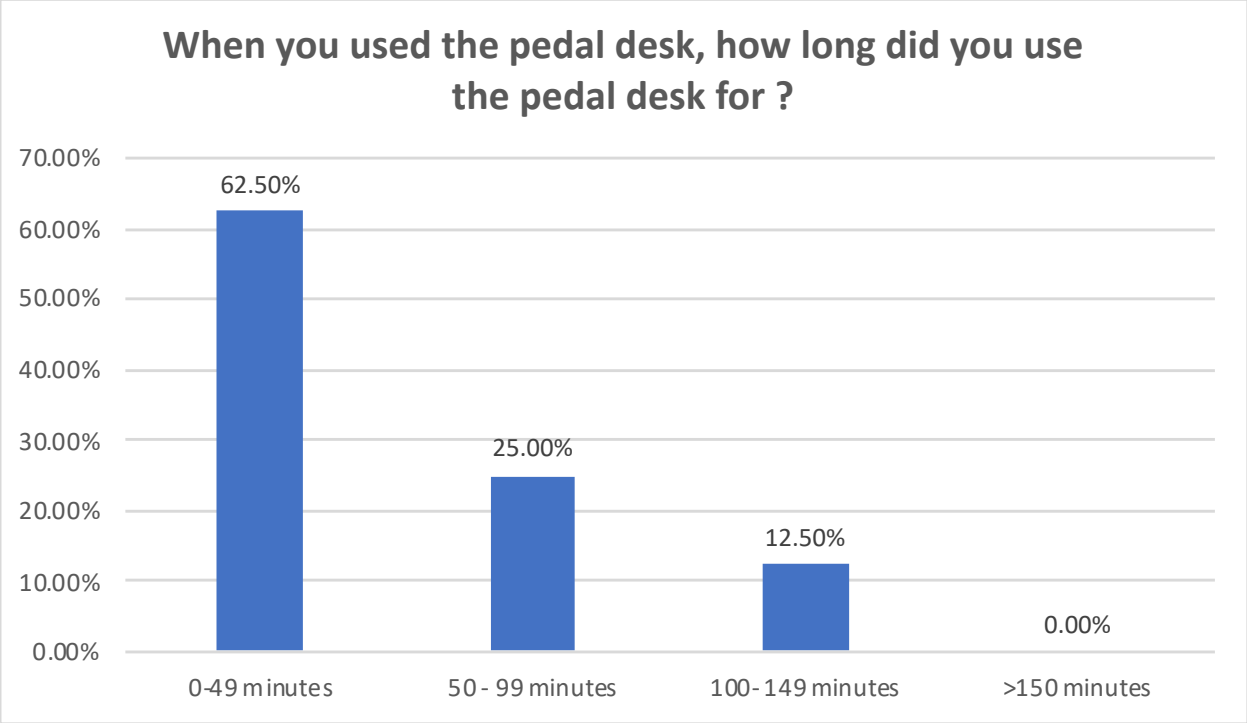

Figure 6- Participants' response to question: When you use the pedal desk, how long did you use the pedal desk for?

When current user participants were asked to report how frequent they use the PD, 62.50% reported they rarely use it, with 62.50% of these students spending between 0 – 49 minutes on the PD (Refer to Figure 6). While other participants reported that they used the PD for 50 – 99 minutes or 100 – 149 minutes (25%, 12.50%). However, no participants reported using the bike for longer than 150 minutes (Refer to Figure 6).

Perceived Benefits and Motivator to use PDs

All questions were placed on a 7-point Likert scale. 1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly Agree (Emerson, 2017). Analysis of respondents revealed varying perceptions about the benefits of using a PD across 3 of the 4 demographics of respondents: (a) current users, (b) potential users, and (c) potential nonusers. No questions regarding perceived benefits were proposed towards non- users.

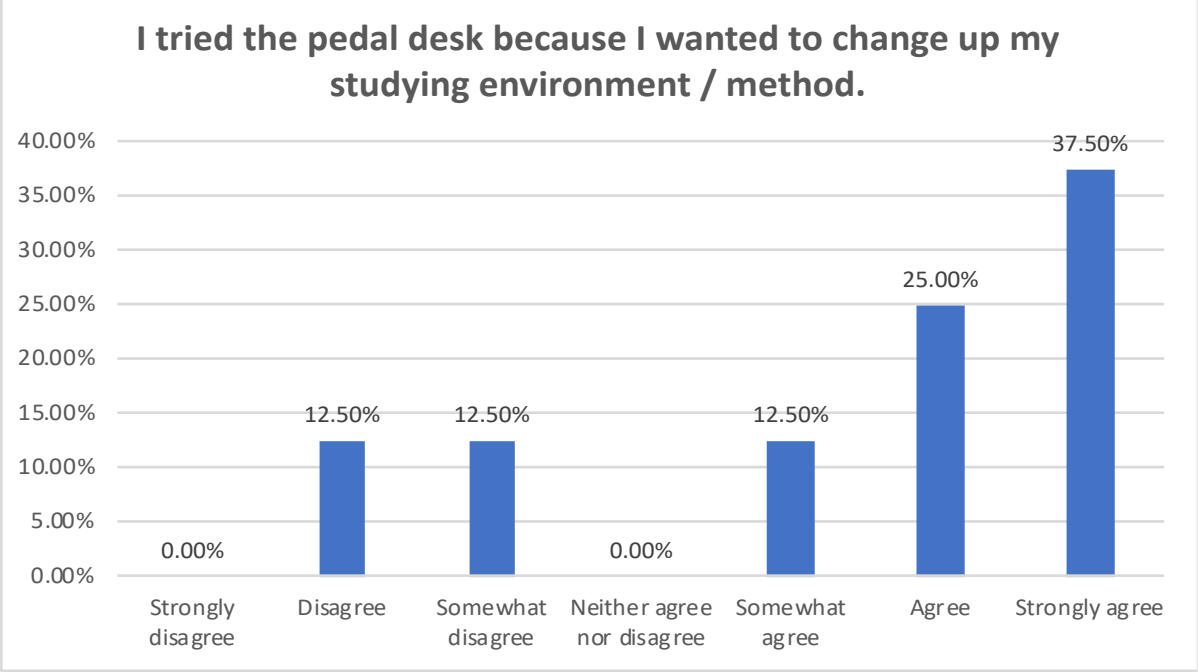

Figure 7- Participants' response to question: I tried the pedal desk because I wanted to change up my studying environment / method

Current Users

From our survey we received responses from 8 current users, participants were asked about their motivations to try to use PDs. Specifically, when asking about whether they chose to use a PD because they wanted to change up their study environment/method, the majority of students responded with "somewhat agree" and

"agree" (m= 5.38) (Refer to Figure 7). Continually, participants selected "agree" about being curious about the PD (m= 5.75) (Refer to Figure 8). All students selected between "somewhat agree" to "agree" meaning they understood the benefits exercise had for their mental and physical health (m = 38) (Refer to Figure 9). Participants were also asked if a motivator for using a PD was to avoid the discomfort from sitting down for long periods of time. Our data suggests this was not a factor for participant motivation as most individuals responded with "somewhat disagree" (m = 3.63). Qualitative data was also collected via an open field question asking what were other factors that motivated participants to use the PD. Students responded saying that *"there weren't any other available desks"* and *"…our professor and textbook explained the risks of SB in short-term and long-term effects."*

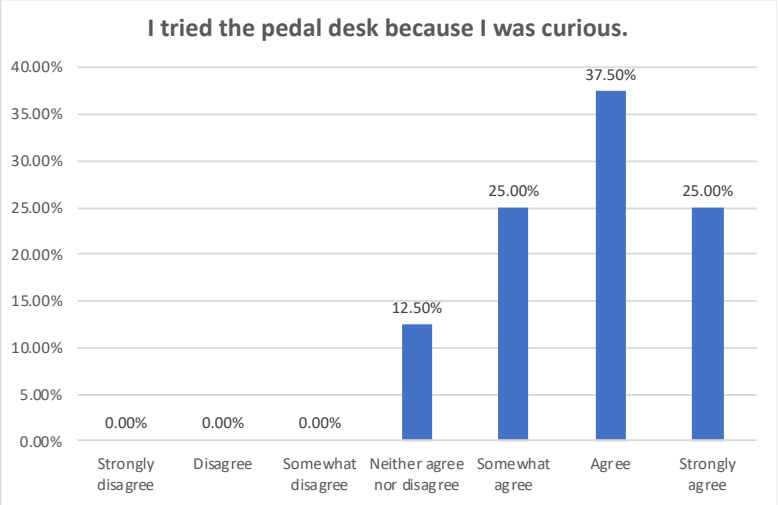

Figure 8 – Participants' response to question: I tried the pedal desk because I was curious.

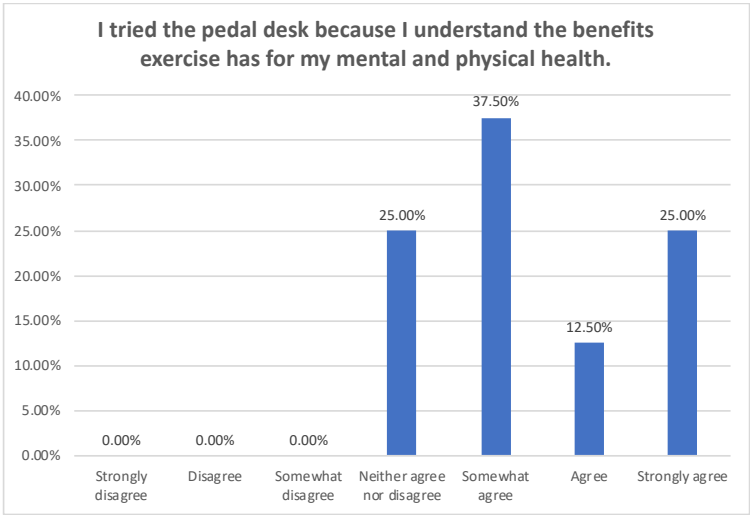

Figure 9 – Participants' response to question: I tried the pedal desk because I understand the benefits exercise has for my mental and physical health.

Potential users

30 respondents were categorized as potential users because they were not previously aware of PDs before but are aware and willing to try it. To determine the motivators for their decision, we provided them with the following statements which assess their motivation. To understand individual perception on the benefits of using active study stations, participants responded to the statement *"I would like to use a pedal desk because I believe it would improve my mental health and overall mood"*. The majority of students selected "somewhat agree" (m = 5.03). A follow-up statement said, *"I would like to use a pedal desk because I believe it would improve my physical health."* Participants responded to this between "somewhat agree" and "agree" (m = 5.97). When asked if students believed the PD would increase their focus and memory, participants were divided as 26.67% participants responded with "neither disagree or agree", while the majority selected "somewhat agree", or "agree" (m = 4.83). To assess student perceptions of personal health, the statement, *"I would like to use a pedal desk because I believe it will decrease my risk for future chronic diseases related to Sedentary Behaviour (i.e. heart disease, Type 2 diabetes, obesity etc ...)*" was asked. Participants responded with "somewhat disagree" (m = 5), with 26.67% selecting "neither disagree nor agree". Lastly, when participants were asked if they believe they were at risk of developing chronic diseases related to SB, the answers selected were between "somewhat disagree" to "neither disagree nor agree" (m = 4.53).

Potential nonusers

Within our sample, 13 participants were categorized as potential nonusers meaning they were unlikely to ever use the PD even though they are now aware of its

existence. To follow-up, we asked these participants what factors could potentially motivate and encourage participation with the active study stations. We approached the question through a qualitative perspective to provide a voice for each participant in order to maximize our understanding. The following question was asked: *"What would motivate you to use the pedal desk?"*. The responses collected surrounded 4 topics, a lack of interest for the PD concept (which combines physical activity and studying), an interest for a reward system, increased comfort on PD seats, and increased locations for study stations (Refer to Figure 5). 7 participants stated nothing would motivate them to use the PD. One student who was not interested in the PD concept said,

> *"nothing, multitasking just decreases the efficiency of both tasks…"*

Another student stated:

> *"not much. Can't focus while on [a pedal desk]"*

The remaining student responses reflected this (Refer to Table 1). 3 student participants interested in a rewards system said, "I would love to use it if there was a reward or incentive", *"some sort of physical reward or incentive"* (refer to Figure 5). Other students stated, *"more comfortable looking seats"*, as well as having PDs "installed in different libraries" would motivate them to use it (Refer to Figure 5).

Perceived barriers of using PDs

Analysis of respondents revealed similar patterns in perceived barriers to using PD across 3 of the 4 demographics of respondents: (a) current users, (b) nonusers, and (c)

potential nonusers. No questions regarding perceived barriers were proposed towards potential users.

Table 2

What are some factors that are preventing you from using the pedal desk more often?

- I'm usually tired when studying
- There are only 2 pedal desks and they are always taken, the pedal desks are very tall and since I am a short (height: 1.55), I find it very uncomfortable because I can't reach properly, the pedal desk seat is also uncomfortable and it is hard to multitask between moving one's legs and writing things or studying.
- I'm never around IKB, or it's occupied

Current users

An open-ended question asking what are some factors that are preventing current users from using the PD more often was specifically addressed to participants who had previously used a PD. Of the 8 current users, only 3 individuals chose to respond. Collectively, 5 unique perceived barriers were identified by current users justifying why they did not use a PD more frequently. One participant found themselves too fatigued to consistently use the PD when studying. Another participant stated they were *"never around IKB"* and when they were the "[pedal desks] *was occupied"* (Refer to Table 2). The final participant provided the most comprehensive response, stating,

> *"There are only 2 pedal desks and they are always taken, the pedal desks are very tall and since I am a short (height: 1.55), I find it very uncomfortable because I can't reach properly, the pedal desk seat is also uncomfortable and it is hard to multitask between moving one's legs and writing things or studying" (Refer to Table 2).*

Current nonusers

Majority of individuals who were aware of PDs but intentionally chose to not use PDs did not identify insufficient knowledge on how to use PDs as a perceived barrier. When asked if they did not use PDs because they did not know how to use it, an overwhelming 81.81% of current nonusers' responses ranged from "somewhat disagree" to "strongly disagree" (Refer to Figure 10). In addition, current nonusers' responses indicate there is an equal proportion of individuals who agree or disagree or remain neutral when asked to identify the unconventionality of using a PD. When asked if they did not use the PD because it was uncommon to use a PD, 42.42% "strongly disagree" to "somewhat disagree", 39.39% "strongly agree" to "somewhat agree" and 18.18% "neither disagree nor agree" (Refer to Figure 11). There are a lot of moving components when using a PD. Thus, when asked if current nonusers perceived PDs as a potential distraction to their studying, 54.54% "strongly agree" to "somewhat agree" (Refer to Figure 12). Significant proportion of current nonusers believed that the discomfort and/or

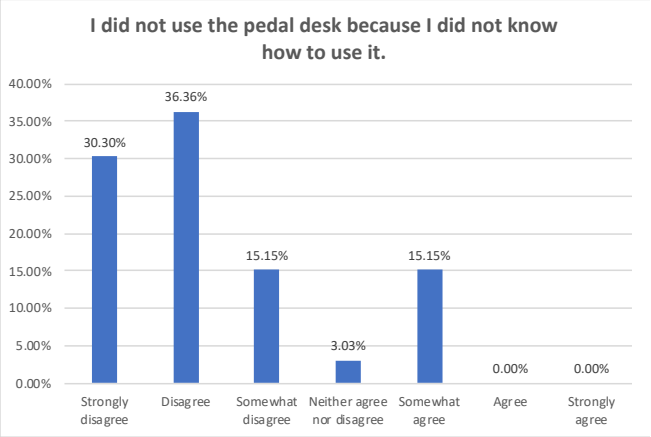

Figure 10 – Participants' response to question: I did not use the pedal desk because I did not know how to use it.

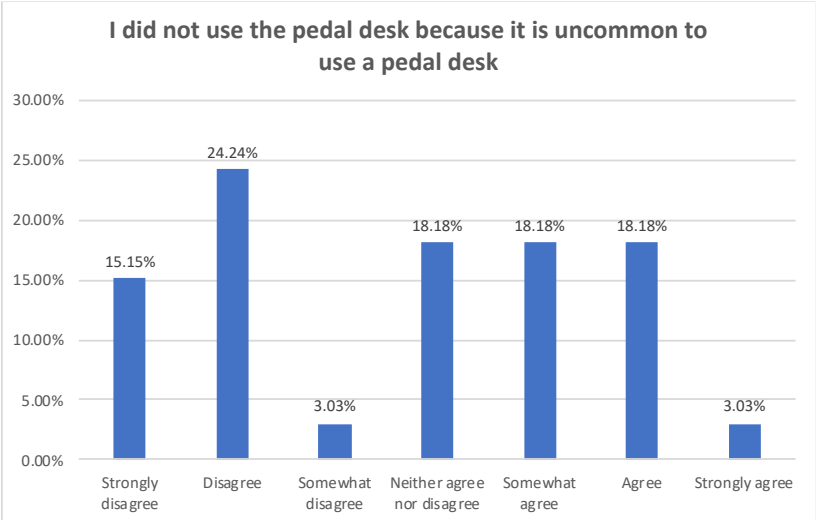

Figure 11 – Participants' response to question: I did not use the pedal desk because it is uncommon to use a pedal desk.

embarrassment of using a PD in front of others was a strong barrier preventing them from using PDs. When asked if they did not want to use a PD because they believed it would be uncomfortable to bicycling in an open area, 69.69% “strongly agree” to “somewhat agree” (Refer to Figure 13). Likewise, 60.60% “strongly agree” to “somewhat agree” when asked if they did not use the PD because they think they would be embarrassed bicycling in an open area in front of my peers (Refer to Figure 14). However, the greatest proportion of current nonusers identified the PDs being readily occupied as a perceived barrier. When asked if they did not use the PD because the machine was already occupied, 66.66% of current nonusers responded with “somewhat agree” to “somewhat disagree” (Refer to Figure 15).

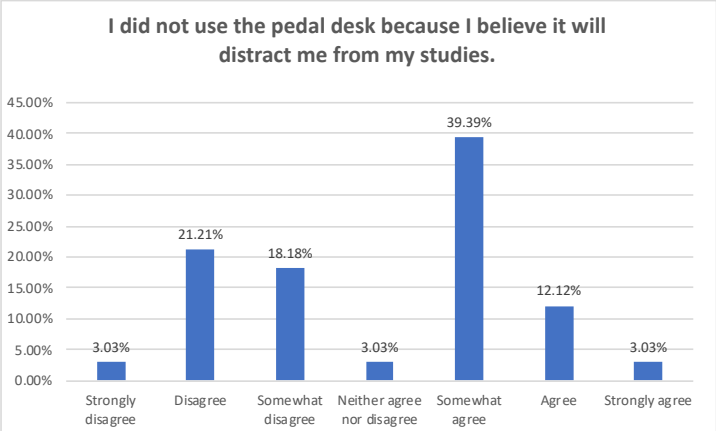

Figure 12- Participants’ response to question: I *did not use pedal desk because it was a distraction*

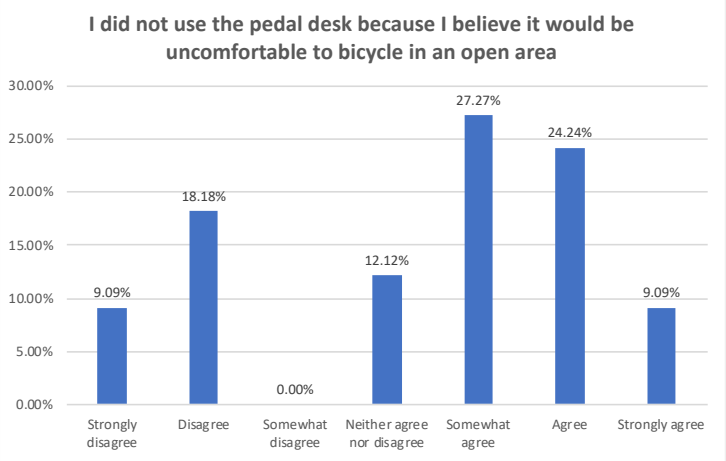

Figure 13 - Participants’ response to question: I did not use the pedal desk because I believe it would be uncomfortable to bicycle in an open area.

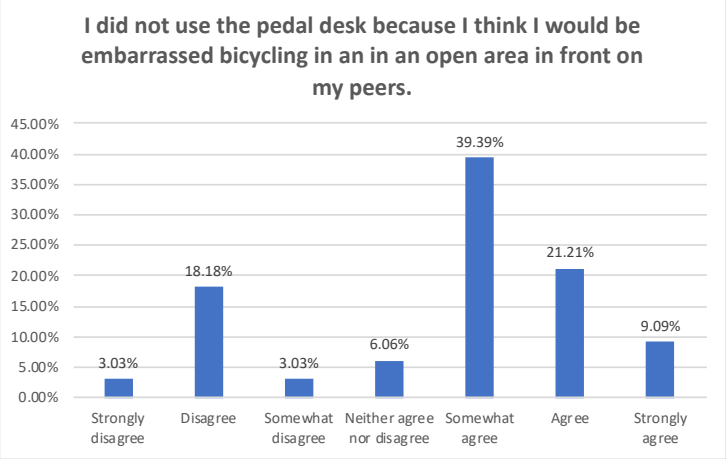

Figure 14 - Participants’ response to question: I did not want to use the pedal desk because I think I would be embarrassed bicycling in an open area in front of my peers.

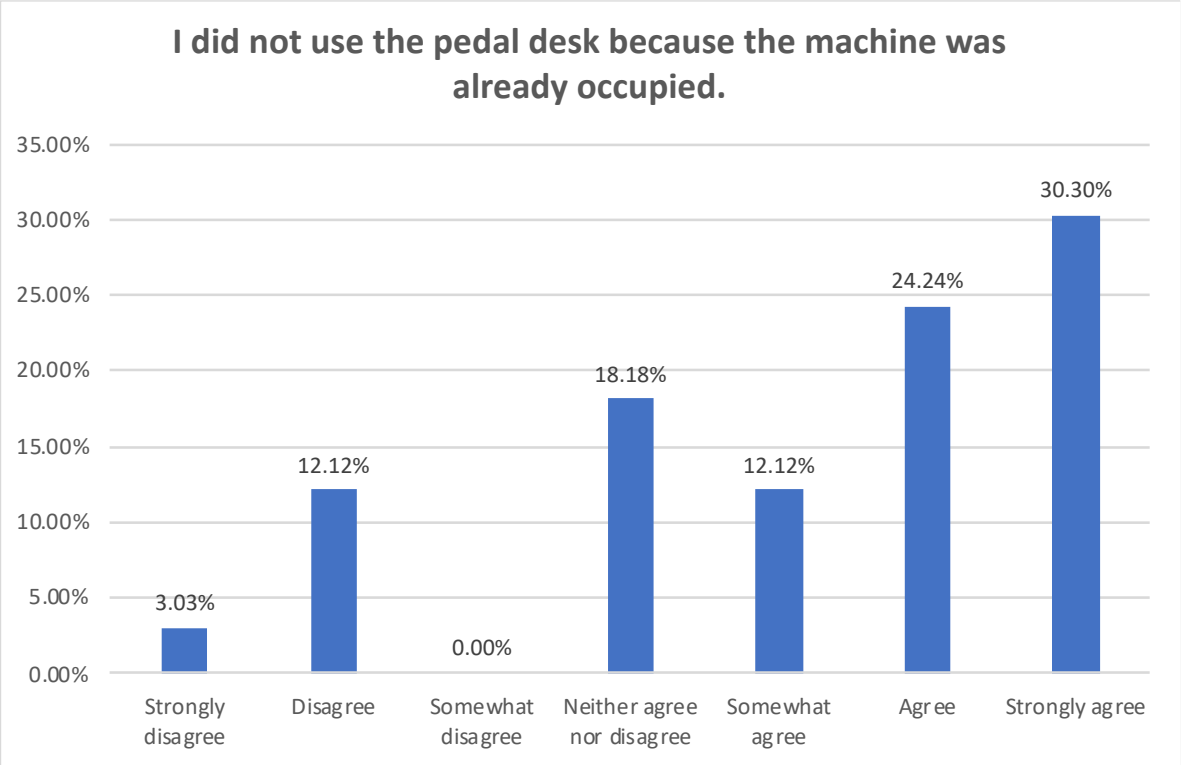

Figure 15 – Participants' response to question: I did not use the pedal desk because the machine was already occupied.

Potential Non-users

Individuals who, prior to the survey had no experience with a PD and have no interest in using it after hearing about PDs in the survey, were required to answer two open questions. In these two questions, potential nonusers' responses revealed a pattern of external and internal perceived barriers to using PDs. Internal barriers are defined as psychological thoughts, feelings, and beliefs inhibiting an individual from engaging in a behaviour (Allison, Dwyer & Makin, 1999). External barriers are defined as physical obstacles that the individual perceives as preventing them from engaging in behaviour (Allison, Dwyer & Makin, 1999). Potential nonusers did not want to integrate exercise into their study regime, and instead *"dedicate time solely to working out vs. doing both at once"* and *"multitasking just decreases the efficiency of both tasks"* (Refer to Table 1 & Table

3). Another participant stated, *"I just don't believe in mixing cardio with studying"* (Refer to Table 3). These individuals speculate that the PD to be loud and distracting so they avoid using PDs because they believe it would negatively affect their work productivity. External perceived barriers expressed by potential nonusers were the geographic location of PD installations and physical discomfort of the seating on PDs. Currently, there is only one PD installation available on campus in the IKB library and potential nonusers found the installation to be far from where their classes are located. Others perceived that using the PD to be *"not worth the discomfort"* (Refer to Table 1).

Table 3

What are some internal or external barriers preventing you from using the pedal desk?

- Location, don't usually study on campus
- I lack motivation to go use the pedal desk
- I like to study at home
- I might sweat too much when pedaling and that would be embarrassing.
- I just don't believe in mixing cardio with studying.
- If I want to get active, I would rather be on the gym and workout intensely or play sports and then study after
- Far from engineering buildings.... comfort while studying....
- I like comfortable seating
- It might be loud and distracting to others. I work out every single day anyways so its fine if i don't do this
- I would rather dedicate time solely to working out vs. doing both at once
- don't study at IKB library
- I just don't want to ride a bike while I study

Perception of PDs as an effective health intervention

The final set of analysis assessed the participants' perceptions as an effective health promotion tool for students for 3 demographics of respondents; (a) current users and (b) potential users. No data was collected on current nonusers in this domain.

Current users

Individuals with previous PD experience demonstrated an understanding on how PDs can facilitate mental and physical health. When individuals were asked if they had used a PD because they understood the benefits exercise has for my mental and physical health, 75.00% of current users selected responses ranging from “somewhat agree” to “strongly agree” (Refer to Figure 9). However, current users did not find a PD as an effective solution to alleviate the physical discomfort of sitting for longer periods of time. 50.00% “disagreed” and 12.50% “neither disagree nor agree” to that statement that they used the PD due the physical discomfort from sitting down for long periods of time (Refer to Figure 16).

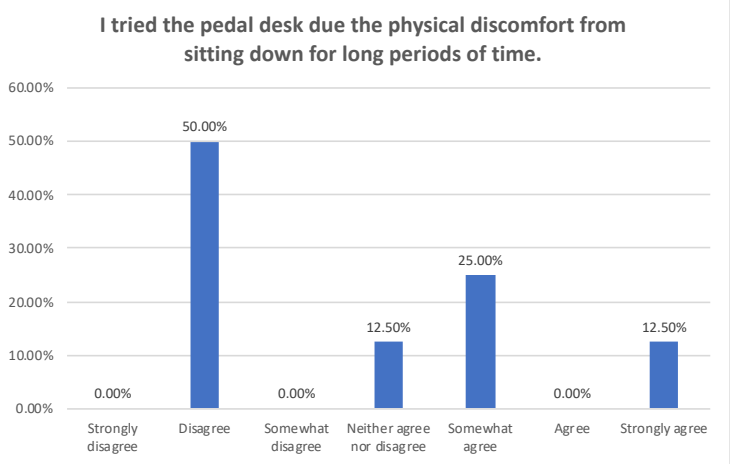

Figure 16 – Participants’ response to question: I tried pedal desk due to physical discomfort of sitting for long periods

Potential users

Similar to current users, a significant proportion of people interested in trying PDs considered PDs as an effective tool to promote mental and physical health. When potential users were asked if they were considering using a PD because they believed it would improve their mental

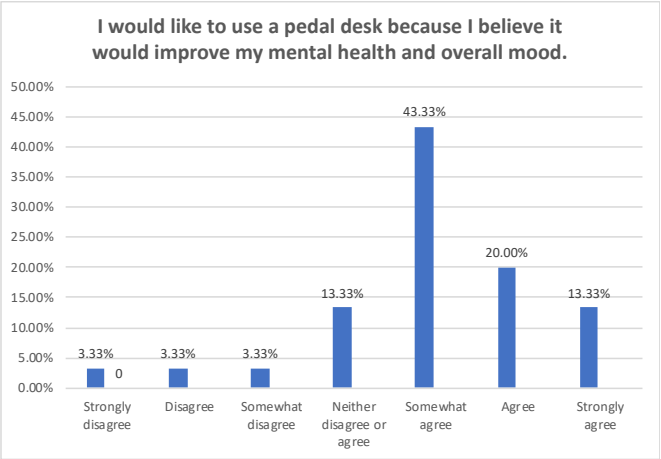

Figure 17- Participants’ response to question: I would like to use a pedal desk to improve mental and overall mood.

health and overall mood, 76.66% of participants selected responses ranging from “somewhat agree” to “strongly agree” (Refer to Figure 17). In addition, 83.34% of participants selected “somewhat agree” to “strongly agree” when asked if they believed using a PD would improve their physical health (Refer to Figure 18). Furthermore, 66.67% of potential users also recognized the PD as an effective method to reduce the risk of developing chronic diseases (Refer to Figure 19).

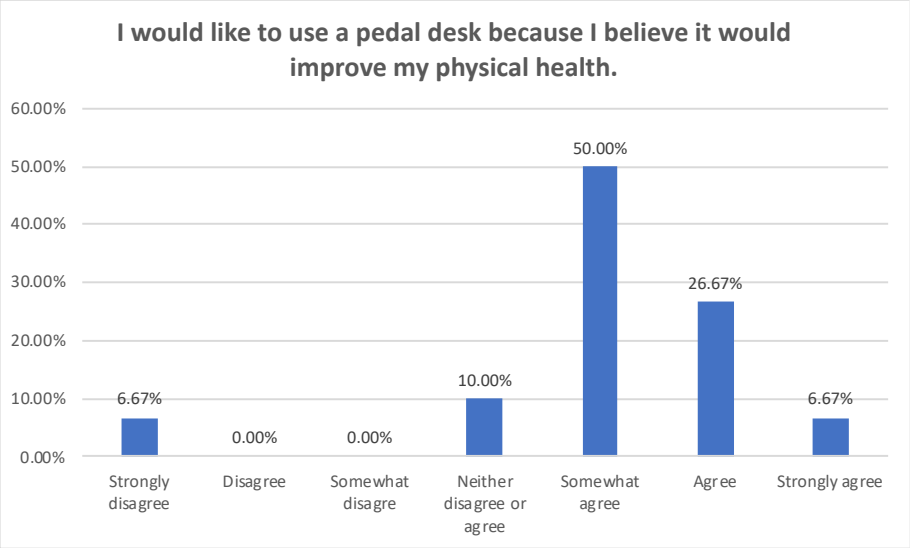

Figure 18 - Participants’ response to question: I would like to use a pedal desk to improve physical health

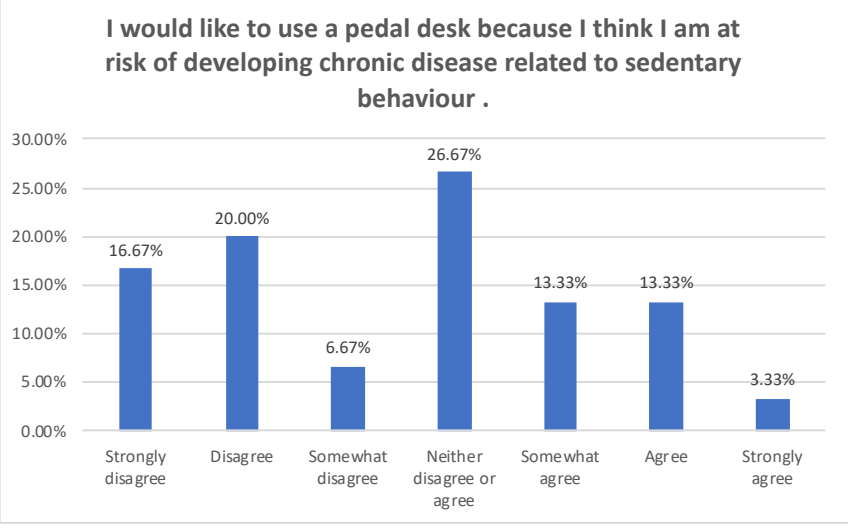

Figure 19 - Participants’ response to question: I would like to use a pedal desk because they believe they are at risk of developing chronic diseases

Potential nonusers

Participants who had no interest in partaking in PDs held significantly contrasting views on using PDs as a health intervention. In an open-ended question item, no participant identified the PD as an alternative to traditional structure exercise. Consequently, these individuals did not "*believe in mixing cardio with studying"* and preferred to *"dedicate a time to solely working out"* (Refer to Table 1).

DISCUSSION

Health Belief Model Definition

In order to guide our discussion themes, we will be utilizing the Health Belief Model (HBM). We have chosen the Health Belief Model because it allows us to understand the potential psychological and/or behavioural roots of the respondents' answers. Further, by understanding our data from a psychological and behavioural perspective, this can help create more effective strategies for active study stations in the future.

The HBM aims to understand the failure to comply with necessary disease prevention strategies using psychological and behavioural frameworks (LaMorte, 2019). Further, this model consists of factors like demographic variables, psychological characteristics, perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues to action (LaMorte, 2019). These factors work together to explain the influence an individual has towards a health intervention. For the sake of our discussion, we will only be focusing on demographic variables, psychological characteristics, perceived susceptibility, perceived benefits, perceived barriers, and cues to action. This is due to the fact that these variables are the most relevant to our findings and will contribute to more accurate recommendations.

The HBM considered demographic variables (ex: class, gender, age) and psychological characteristics (ex: personality, peer group pressure) (LaMorte, 2019). With these variables, we can attempt to understand many of the innate explanations for certain behaviours, or in this case, the adherence to health interventions. Additionally, perceived susceptibility is considered. Perceived susceptibility refers to the individual's subjective perception of the risk of acquiring an illness (LaMorte, 2019). This is particularly important because the lack of perceived susceptibility could influence individuals into underestimating the seriousness of health interventions, and thus not partaking in health interventions. Additionally, the HBM considers perceived benefits and barriers. Perceived benefits refer to the perception of the effectiveness of prevention methods against the disease (LaMorte, 2019) This factor is important because it can act as a strong motivator for health intervention compliance. In the event of high perceived benefits, individuals are found to be more engaged and motivated in health initiatives (LaMorte, 2019). Perceived barriers refer to the potential obstacles that one may face when considering preventative methods (LaMorte, 2019). The number of barriers or severity of barriers may further inhibit one from engaging in necessary preventative measures. Lastly, the Health Belief Model considers cue to action a. Cue to action is a stimulus that triggers that necessary decision-making process to either accept or reject the recommended health action (LaMorte, 2019). Further, these cues to actions can either be internal (ex: chest pains or wheezing) or external (ex: illness of family members, advice from others). Overall, cues to action can act as triggers that can ultimately decide whether individuals comply with health interventions or not (LaMorte, 2019).

Perceived Barriers

According to the HBM, perceived barriers refers to the perception of cost associated with participating in a health behaviour (LaMorte, 2019). It involves the cost-benefits analysis of whether engaging in behaviour will reduce or eliminate the perceived threat (Kagee & Freeman, 2017). The results from this study found similarities in perceived barriers between potential non-users' and current nonusers' attitudes to using PDs. Both current and potential nonusers' responses revealed a strong bias towards the presumption that utilizing a PD will reduce their productivity and negatively affect their cognitive focus. In a question assessing whether current nonusers believed PDs will distract them from their studies, 54.54% answers ranged from "strongly agree" to "strongly disagree" (Refer to Figure 12). Likewise, many potential nonusers' responses in an open-ended question articulated that they would prefer to keep studying and exercising as separate tasks. They believed that *"multitasking just decreases the efficiency of both tasks"* (Refer to Table 1).

Contrary to students' concerns that they may experience difficulties trying to balance the tasks of studying and the physical demands of the PD (Hamilton, Foster & Potter, 2018; Tardif et al., 2018), strong empirical evidence illustrates that PDs can facilitate PA with minimal to no effect of task performance such as typing (Koren, Pišot, & Šimunic, 2016). Similarly, a study comparing students taking an exam while in a seated position versus stationary cycling found that cycling did not negatively affect students' test scores (Mahar, Murphy, Row, Golden, Shields, & Raedeke, 2006).

Furthermore, current studies illustrate that implementing in an office workplace setting can enhance cognitive performance. In a study by Torbeyns et al. (2016), participants instructed to cycle at 30% of their maximal external power showed

improvements in certain aspects of executive functioning relative to participants who performed the same task in a seated stationary position.

Notably, studies reporting cognitive benefits of using a PD have been an acute intervention. However, the immediate effects of practicing cycling while studying suggests that longer interventions may yield greater cognitive benefits and long-term improvements in academic performance. In a study by Joubert et al. (2017), students registered in an undergraduate physiology course were invited to participate in a 12-week intervention program. Individuals who chose to enroll were randomly assigned to sit at a traditional desk (SIT) or stationary cycling desk (CYC) during lecture time. Consequently, findings showed that the students in the CYC group outperformed students in the SIT group in all written tests and overall course grades.

Therefore, contrary to potential and current nonusers' perception that PDs are a distraction, empirical evidence suggests that PDs do not impede but rather enhance learning and productivity.

Individual and Psychological factors

Our demographic data shows that 92.86% of the participants are sedentary for more than 5 hours in their day (Refer to Figure 21), and only 38.10% of these participants are meeting the required CPA guidelines (Refer to Figure 22) of

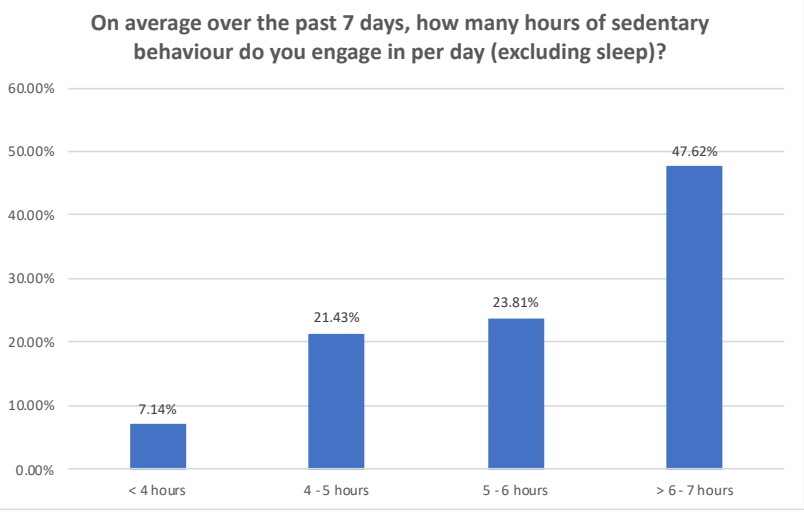

Figure 21 - Participants' response to question: On average over the past 7 days, how many hours of sedentary behaviour do you engage in

150 minutes of MVPA (Trembley et al., 2011). In line with research, we see that only 11.11% of study breaks were spent doing physical activity while the other forms were spent on social media platforms, eating, and watching streaming services (Refer to Figure 4) – all which are sedentary activities (Gebel, Pont, Ding, Bauman, Chau, Berger, Prior, & CaMos Research Group, 2017). As previously mentioned, research is unclear if physical activity counteracts the negative effects of SB, and therefore both groups of students, physically active or inactive, still run the risk for SB health consequences (Tremblay, LeBlanc, Kho, Saunders, Larouche, Colley, Goldfield, & Connor Gorber, 2011). Specifically, students are easily susceptible to sedentary behaviour consequences because the nature of student life consists of hours of studying like those who have a desk-based occupation (Buckley et al., 2015). In order to encourage a decrease in SB, we wanted to inform students of active studying options known as the PD. Using a PD allows students to cycle while studying which has been shown to decrease the effects of SB consequences and is non-intrusive towards cognitive or mechanical performance (Torbeyns et al., 2016). According to the HBM, personal and psychological factors affect the way they perceive susceptibility, severity, benefits, barriers, and have a cue to action (LaMorte, 2019). Participant responses suggested that

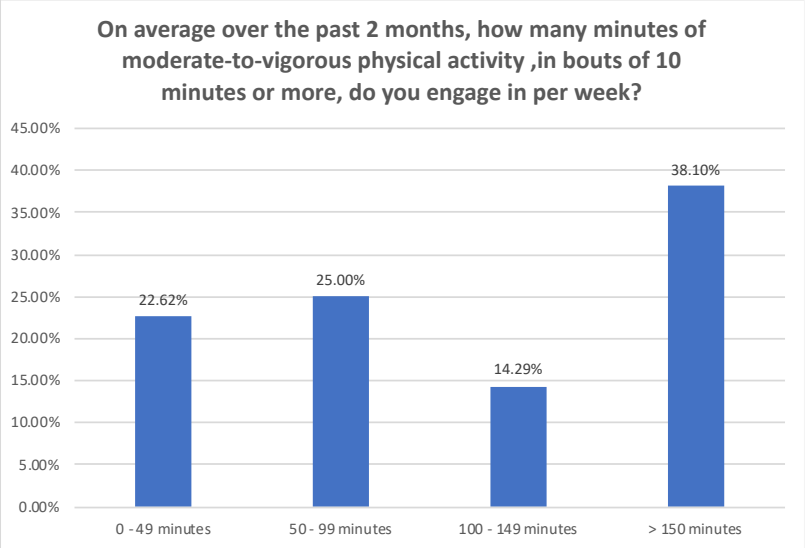

Figure 22 - Participants' response to question: On average over the past 2 months, how many minutes of moderate-vigorous physical activity, in bouts of 10 minutes of more do you engage in per week?

55% of participants (current nonusers: n = 33,potential nonusers: n = 13), are reluctant to try the PD as it is inconvenient, distracting, and unpleasant to exercise and study at the same time – believing they would not be able to do both effectively without trying it out (Refer to Table 1). A psychological concept known as self-efficacy, is an individual's beliefs in their own ability to execute behaviours in order to produce a specific task (Bandura, 1977, 1986, 1997). Self-efficacy reflects one's confidence to have control over one's motivation, behaviour and environment (Bandura, 1977). Therefore, students who are reluctant to try out PDs have low self-efficacy in their ability to focus well while pedaling. On the contrary, individuals with high self-efficacy, feel confident in their abilities to cycle while studying and believe in the health benefits of the PD. Therefore, self-efficacy is a significant predictor for engaging health promoting behaviours, like using a PD (Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004). This will translate to the types of participant responses received for each perceived element within the HBM, and thus reflect an individual's willingness to use PD. Current users also responded that they used the PDs because they wanted to change up their studying environment and method and were curious about the PDs (Refer to Figure 7 & Figure 8). Individuals curiosity and interest can be deconstructed through the lenses of the self-determination theory which explains how psychological needs must be satisfied first in order for an individual to feel motivated towards engaging in activities and behaviours (González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016). Moreover, an individual's intrinsic motivation is characterized by their natural inclination towards novelty and exploration and thereby considered as a necessary psychological need (Ryan & Deci, 2000). As a result, behaviors such as being intrigued by an interesting activity will lead individuals to seek new experiences (Deci &

Ryan, 2000). This phenomenon of interest for novelty is reflected by participants' curiosity to try the PD The implementation of a PD can also be perceived as a refreshing and innovative form of a standard seated desk and therefore makes an excellent marketing tactic to catch the attention of potential users (Bastien Tardif, Cantin, Sénécal, Léger, Labonté-Lemoyne,Begon, & Mathieu, 2018). Additionally, more awareness of active study desks has been circulating around different news outlets, such as CTV News, The Atlantic, and HuffPost, which suggests to audience members that this form of sitting may be something worth trying out (Hananel, 2013; Lam, 2015; Tomasi, 2016). Therefore, curiosity and wanting a change of environment may be an important factor in influencing once perception about the PD.

Perceived Susceptibility

Perceived susceptibility refers to how severe individuals perceive their risk of acquiring an illness (LaMorte, 2019). In turn, we can use perceived susceptibility to reflect how students feel about the potential risk of developing various chronic illnesses due to SB. This was particularly shown during our research, when we asked potential users questions related to their perceived susceptibility. For example, a survey question asked potential users if they believe that active study stations will decrease their risk of chronic illnesses related to SB ("*I believe [active study stations] will decrease my risk for future chronic diseases related to sedentary behaviour*") (Refer to Figure 26). By asking this question, we are evaluating if students viewed active study stations as a viable and effective solution to the consequences of SB. The respondents average answer on the Likert scale was "somewhat agree" (m=5) (Refer to Figure 26). When evaluating these

answers, it is clear that potential users have a slight understanding of the implications of active study stations on the prevention of chronic illnesses caused by SB.

However, an additional question was asked to potential users, asking about their perceived risk of developing chronic diseases related to SB ("*I think I am at risk of developing chronic disease related to sedentary behaviour*") (Refer to Figure 19). Of the respondents' answers, the average answer was "neither disagree/agree" or "somewhat agree" (m=4.53) (Refer to Figure 19). This shows that, although students were educated on the benefits of active study stations, they still do not perceive their risk to chronic illnesses as severe. These findings align with a study done by Smith et al., (2012), where they found that university students perceived their risk of chronic diseases as low. Such chronic diseases consider diabetes, obesity, cancer, and heart disease as low (Smith et al., 2012). Further, according to the HBM, this perception can hinder student's adherence to necessary health interventions (LaMorte, 2019).

Perceived Benefits

The third aspect of the HBM to predict an individual's engagement in health behaviours are their perceived benefits that arise from participating in a behaviour (LaMorte, 2019). In this case, we had two sets of groups who showed different behaviours - current users and potential users, compared to nonusers and potential nonusers. Students categorized as current users enjoyed using PDs for its unique concept and believed in the health benefits of using it. Our findings suggest that 75% of our current users used a PD because of the benefits it had for physical and mental health (Refer to Figure 9). A current user participant response stated that the reason began to use the PD,

"… our professor and textbook explained the risks of sedentary behaviour in short-term and long-term effects… decided to try [pedal desks] as a way to remain active while I study."

Likewise, potential users showed similar findings in which 83.34% stated they would like to use PD's because they believed it would improve their physical health (Figure 18), and 76.66% using it would improve their mental health (Figure 17). Therefore, with our understanding of the HBM, this theory helps us understand the perceptions of individuals who are likely to engage in healthy behavior change as it relates to SB. (LaMorte, 2019). These main points suggest that current users are motivated by either external or internal factors, which collectively contribute to individual motivation for engaging in seated cycling. Though, it is important to note that these current users do not use the PD often, as 62.25% of the participants said they spent 50 minutes or less on the bike, and none reported using it for more than 150 minutes at a time (Refer to Figure 23, Figure 24). Nonetheless, we believe that every little bit counts so it is better that these students use the PD for small bouts of time, rather than not using them at all.

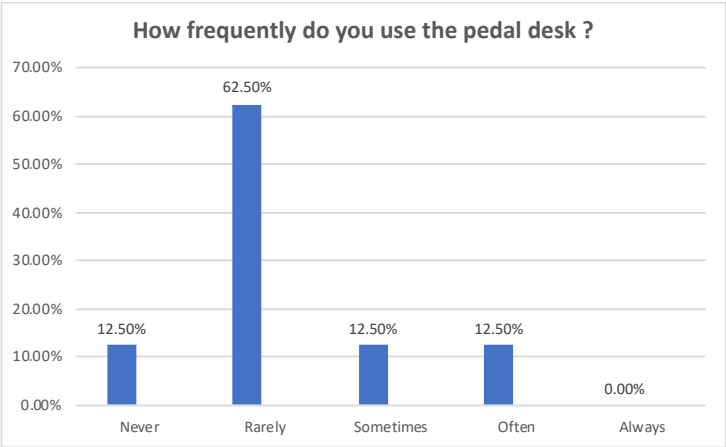

Figure 23 - Participants' response to question: How frequently do you use the pedal desk?

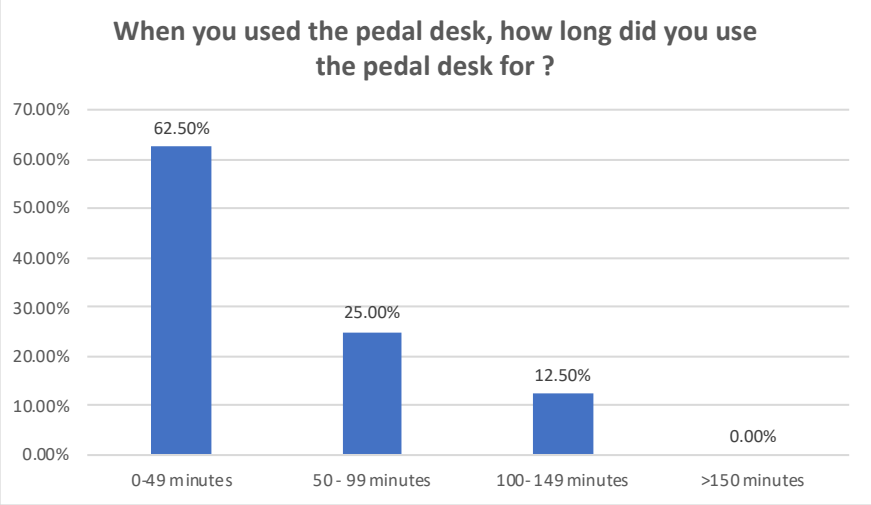

Figure 24 - Participants' response to question: When you used the pedal desk, how long did you use the pedal desk for?

In contrast, our findings from our nonusers and potential nonusers demonstrate that potential users show reservations to their perceived benefits for using PDs. Overall, 54% of nonusers believed that using a PD would distract them from their studies (Refer to Figure 12). Similarly, this was the same factor that prevented potential nonusers from receiving positive health benefits of using a pedal desk. In an open field question, one potential non user shared that *"multitasking just decreases the efficiency of both tasks, I would finish my work and get a good workout in a shorter time than trying to study with this desk."* emphasizing that there is no benefit for themselves to us a PD (Refer to Table 1). Unfortunately, this suggests a gap in our findings as students have the lack of knowledge about the benefits of PD use. Research shows using a PD alternatively to a standard desk will actually decrease an individual's sedentary time, and therefore decrease one's risk for SB consequences (Panahi & Trembaly, 2018). These consequences can lead to chronic diseases such as heart disease, type 2 diabetes, and obesity (Panahi & Trembaly, 2018), which students could be at risk for if they maintain SB patterns. With reference back to the HBM, we would suggest that these individuals

are unlikely to use PD as the awareness of the alternative study desk is not effective in producing behavioural change given that the pros are undervalued by the perceived cons (LaMorte, 2019). Without having used a PD before, nonusers and potential nonusers' perceptions reflect a reluctant attitude towards benefits which provides them no incentives to participate in a health behaviour change.

It is important to note that this perspective can be altered for individuals, including nonuser and potential nonuser preferences through possible additions to the active study station installation. Prospective nonusers were asked what would motivate them to use the PD in which participants suggested having a) more locations and b) a rewards system (Refer to Table 1). We believe both are excellent motivators and can be used towards building the initiative. The use of a reward system, also known as gamification, is an excellent strategy that can be used for health promotion as it aims to encourage users to execute a specific task using incentives. This system may contain aspects derived from traditional game qualities such as goal setting, evaluations, and measuring health behaviour change (Marston & Hall, 2015). Therefore, creating a rewards application pertaining to PD would be an excellent way to encourage nonusers and users to take advantage of the external benefits to potentially understand its positive intrinsic properties.

Cues to action

Cues to action can refer to any stimuli that triggers necessary decision-making about health (LaMorte, 2019). Additionally, these cues to actions can either be internal or external measures that influence the level of adherence to a health intervention (LaMorte, 2019). Throughout our data, we had respondents express either positive or negative

triggers that influenced their use of the active study stations. Positive triggers were mostly expressed by current users, however some current users expressed negative triggers as well. For example, some current users expressed that, due to their health education background, they were especially motivated to try the PDs (Refer to Table 4). In this case, the knowledge about the consequences of SB and benefits of physical activity acted as a trigger for students to start engaging in more active forms of studying. However, another user expressed negative triggers that influenced their experiences with PDs. For example, a respondent stated that they did not use the PDs because they are *"usually tired while studying"* (Refer to Table 1). Therefore, this may be a possible factor that can prevent further use of PDs for this current user. Additionally, another user expressed that the PDs were uncomfortable, which later discouraged them from using the PDs. In this case, the physical characteristics of the PDs negatively impacted the respondent's perceptions of PDs. Overall, it is important to note these triggers as they have shown to be strong influencers on individual decisions about health interventions. Further, by understanding these triggers, we can look for alternative strategies to help encourage students to engage with the active study stations.

Table 4

What are some other factors that motivated you to use the pedal desk?

- In one of my courses (health psychology), our professor and textbook explained the risks of sedentary behavior in short-term and long-term effects. I then saw on social media that the pedal desk was in IKB and I decided to try it out as a way to remain active while I study.
- There weren't any other available desks

RECOMMENDATIONS

RECOMMENDATION #1: *Adjustable Seating*

SEEDS can improve the quality and comfort of the seats on the PDs. Students felt uncomfortable using the PDs which decreased the duration that they used the PDs. The seat on the PDs is similar to the shape of a real bicycle seat. The seat has little cushioning and is very narrow. Some students might have trouble balancing on the seat and people who are overweight or obese might not fit on the seat. The seat is also very stiff with little cushioning which can cause soreness on a person's body. According to Figure 24, students used the PD for less than 40 minutes which may indicate that the seat is uncomfortable. SEEDS can increase the comfort by increasing the width of the seat and adding more cushioning so people can study and complete schoolwork for longer periods of time. A semi recumbent backrest can also be added to help people feel more comfortable and stable while pedaling. The backrest will provide more support for the person while not taking away from the physical activity of the PD. Adjustability can also be improved on the PD. Although the desk height and seat height are both adjustable at the current PD, the distance of the pedals cannot be adjusted. One respondent said they "*[found] it very uncomfortable because I can't reach properly*" (Refer to Table 4). We assume the respondent is referring to the distance from the pedals and the seat because it cannot be adjusted forwards or backwards. Therefore, we recommend that the distance from the seat and the pedals be made adjustable. This accommodates for the various leg lengths of the users. Additionally, because the desk height is adjustable it must be suitable for both users because the desk is shared. If the two users are different heights or sizes, it might not be possible to meet the comfort preferences of both users. SEEDS can add

additional adjustable desks so each user can personally adjust the height of their desk. The tension of the pedals is also very low at the current PDs and it cannot be increased. By increasing the tension, students might feel more productive by pedaling harder which can also increase use of the PDs. By making these adjustments and modifications, we hope that this increases the use of the PDs and accessibility for the whole UBC community.

RECOMMENDATION #2: *Education Campaign*

Educating the UBC community of the risks of SB and the benefits of active study stations would also increase the use of the PDs. In the open-ended question where students were asked what would motivate them to use PDs, one respondent said, *"I feel like instead of pedaling I would rather gym and then focus on my studies after*" (Refer to Table 1). Two other respondents both said they would rather go to the gym than multitask by studying and using the PD at the same time. In another open-ended question where respondents were asked about the internal and external barriers that were preventing them from using the desk, one respondent said *"It might be loud and distracting to others. I work out every single day anyways so* [it's] *fine if I don't do this"* (Refer to Table 3). Two other respondents also get exercise often, so they assume being sedentary for long periods of time is not a concern. However, it is unclear if physical activity reduces the risks of the diseases associated with SB (Tremblay, Colley, Saunders, Healy & Owen, 2010). Therefore, we recommend that SEEDS should educate the UBC population of the risks associated with SB. SEEDS should continue to encourage students to meet their daily physical activity requirements, but additionally decrease the duration of SB. The target population of this education session should be towards professors and students.

Therefore, students are encouraged to use the active study stations and teachers can implement activities within their lectures to reduce SBs. We recommend that this education is all encompassing where students and professors are encouraged to use the PD for the first time and can be informed of the benefits from using the PD. We suggest that this information session occur where there are large gatherings of UBC students like during the first week of school or set up a station along Main Mall during Imagine Day.

RECOMMENDATION #3: *Rewards Program*

Using a reward system is a method of gamification that may encourage the usage and awareness of active study stations (Marston & Hall, 2015). For instance, students scanning their student card and tracking their usage in minutes and having that student gain points and small rewards, such as a coffee, may provide some external motivation that may help certain individuals use PD. As seen in our findings, a few respondents suggested having a reward for exercising during their studies and therefore we suggest a potential rewards system in either UBC points or rewards system to motivate students. A potential addition which may work well with the rewards system is allowing the PD or the treadmill desks to track calorie expenditure and other beneficial health data. Furthermore, the data collected such as calorie expenditure and duration of the usage can be used as the criteria for the rewards system. For example, someone who uses the PD for 30 minutes receives one reward point and for every 100 calories expended, they receive one point. The reward points could be monitored through UBC Student Services Centre or even a mobile app. Additionally, an implementation of a referral system where students can refer their friends to use the PD and earn additional points may be a good method of increasing awareness.

RECOMMENDATION #4: *Expanding Locations*

Increasing the accessibility of the active study stations to other locations is another recommendation that will help increase awareness and usage. With the PD and treadmill station being only located in IKBLC, it limits those who are on the other side of campus to try out the PD since other libraries and popular study locations may be closer and more convenient. We suggest installing more active study stations for students who do not have class close to IKBLC. Increasing the number of libraries with active study stations will increase accessibility and availability for all students. Not only does this provide easier access to those seeking to use the active study stations, it also increases the awareness of these machines to those students who have never visited IKBLC.

LIMITATIONS

The small sample of the data collected is a limitation when viewing the reliability of the findings where a total of 84 UBC students participated in the online survey and only 41 of the respondents have heard or seen the active study stations at IKBLC (Refer to Figure 5). Given that only 41 respondents have had previous knowledge of the active study stations, it may be a challenge to make conclusions based on the findings as because the small sample size is not a valid representation of the UBC community. The difficulties of obtaining a greater number of respondents were limited by the COVID-19 outbreak which prevented us from conducting in-person surveys. Additionally, a bulk of the respondents were Kinesiology and Science students which may have been a result of selection bias (McEwen, 2019). In other words, when members of the group shared the survey on their social media accounts, those who would have accessed the survey

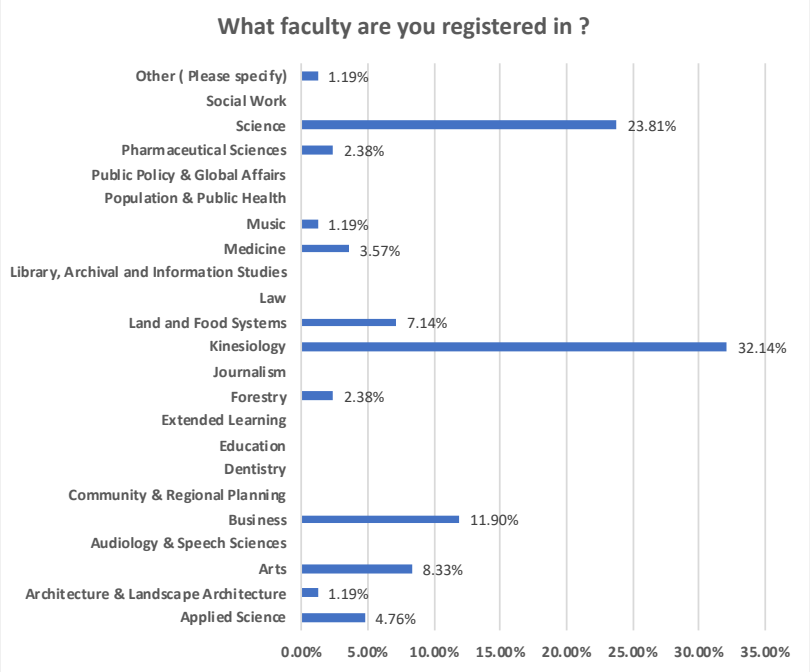

Figure 25 – Participants' response to : What faculty you are registered in?

were more likely to be Kinesiology and Science students since most of the friends of the group members were in these faculties. Additionally, the lack of responses from members of other faculties across UBC, like Law, Dentistry, and Education is another limitation of the data where those faculties had zero to little responses (Refer to Figure 25). Ultimately, with the majority of our data regarding the active study stations being collected from Kinesiology, Science and Business students, this could lead to unreliable findings and conclusions as it is not representative of all the students on campus. The use of in-person techniques were limited to posters with QR-codes located inside Students who do not go to The Nest, The Life Building, and IKBLC would not be able to complete the survey because posters and flyers were only posted in these buildings. Finally, the inability to conduct in-person surveys resulted in a smaller sample of respondents than expected since the only options were online surveys and posters with QR-codes.

CONCLUSION

As UBC students, we noticed that many of our peers, as well as ourselves, are spending most of our days being sedentary. Whether these SBs consist of studying,

eating, browsing social media, or transiting, they all have critical implications on our health. Long durations of SB can increase risks of chronic disease like diabetes, cancer, heart disease, and obesity (Smith et al., 2012). However, UBC has tried to combat SBs by implementing active study stations in IKBLC. Although active study stations were installed, almost 50% of students were not aware of the active study stations in IKBLC (Refer to Figure 5). Therefore, we tried to address dissemination by recommending an education campaign during a popular event like Imagine Day. This education campaign would spread awareness of the current PDs and educate the UBC community of the benefits of using PDs. Surprisingly, the students who were newly aware of the active study stations were still not interested in using them. Therefore, we discussed students' reasons for not using the PDs through the HBM. Using this model, we discussed the perceived barriers, perceived benefits, and perceived susceptibility of students regarding PDs and their impact on health problems. After we discussed student's beliefs using the HBM, we used their feedback to create more recommendations for SEEDS including increasing comfort of the seat, installing more active study stations throughout campus, and implementing a rewards system. We also saw a gap in the findings as individuals who learnt about the PD's still had reservations for the concept. Through it we added an additional recommendation that SEEDS would increase educational initiatives to further encourage students about taking more active measures to decrease their sedentary behaviour.

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Appendix A- Survey Questions

Q2.1 - How did you hear about our survey?

In person
Social Media
Flyer
Other

Q2.2 - Are you currently a student at UBC?

Yes
No

Q2.3 - What gender do you identify as?

Male
Female
Other _____
Prefer not to disclose

Q2.4 - What type of program are you enrolled in?

Bachelor's
Master's
Doctorate
Other (Please specify) _____

Q2.5 - What is your current year in school?

1st Year
2nd Year
3rd Year
4th Year
≥ 5th Year
Graduate school / Other

Q2.6 - What faculty are you registered in?

Applied Science	Land and Food Systems
Architecture & Landscape Architecture	Law
Arts	Library, Archival and Information Studies
Audiology & Speech Sciences	Medicine
Business	Music
Community & Regional Planning	Population & Public Health
Dentistry	Public Policy & Global Affairs
Education	Pharmaceutical Sciences
Extended Learning	Science
Forestry	Social Work
Journalism	Other (Please specify) _____
Kinesiology	

Q2.7- What is your current living situation?

On campus
With parents/ guardians
Off campus / other

Q2.8 - Sedentary behaviour is classified as sitting for periods of time where the body is at a low energy expenditure (Owen et al, 2010). This includes, but not limited to, activities such as sitting at a desk during school or work, sitting in transportation, watching TV, computer use, reading and sit down meals. On average over the past 7 days, how many hours of sedentary behaviour do you engage in per day (excluding sleep)?

<4 hours	4-5 hours	5-6 hours	>6-7 hours

Q2.9 - A Borg CR10 Scale is a measure of rating perceived exertion that is used to gauge the intensity of exercise. According to the Borg scale, moderate to vigorous activity ranges from a rating of 4 - 8.

Maximum Effort - 10	Feels almost impossible to keep going. Completely out of breath.
Very Hard Activity- 9	Very difficult to maintain intensity. Barely breath and speak a few words.
Vigorous Activity – 7-8	**Borderline uncomfortable. Short of breath, can speak a sentence**
Moderate Activity – 4-6	**Breathing Heavily, can hold a short conversation. Somewhat comfortable**
Light Activity – 2-3	Feels like you can maintain for hours. Able to carry a full conversation.
Very Light Activity – 1	Hardly any exertion, but more than sleeping, watching TV etc...

This includes **moderate-intensity activities** like brisk walking and bike riding, to **vigorous-intensity activities** like jogging, swimming laps, and cross-country skiing.

On average over the past **2 months (i.e this semester)**, how many minutes of moderate-to-vigorous physical activity (ie ranges between 4 - 8 on BORG scale) in bouts of 10 minutes or more, do you engage in per week? This can include activities in the context of work, exercise sessions, and transportation (i.e. biking).

0-49 minutes	50-99 minutes	100-149 minutes	>150mins

Q2.10 - When you study, how often do you take study breaks?

Never	Every half an hour	Every Hour	Every 2 Hours	I never Study

Q2.11 - What type of activities do you typically do during your study breaks? Select your **top 3 choices**.

Browsing social media (e.g. Instagram, Facebook, Twitter etc...)	Eating	Sleeping	Video gaming	Watching YouTube	Watching cable TV or TV streaming services (e.g. Netflix, HBO, Crave, Disney+ etc ...)	Structured exercise at a facility (e.g. Going to the gym, attending studio fitness classes)	Leisurely Exercising (e.g. walking, jogging, home exercise)

Q3.1- The Physical Activity Office in partnership with Irving K Barber Library has recently installed active study stations in the library. This permanent installation includes two stationary bikes and an adjustable height desk.

The **purpose** of this project is to understand student's experiences specifically with the current pedal desk installations. We will focus on the effectiveness of the pedal desk, how often they are used, awareness, and any other relevant information that can help inform future installations of the pedal desks.

Please read each statement and provide an answer that best reflects your understanding of the pedal desk installations.

Q3.2 - Prior to this survey, have you heard or seen about the active study station pedal desk installation at the Irving K Barber Library?

Yes	No

Q3.4 Have you used the pedal desk before?

Yes	No

Q3.5 How frequently do you use the pedal desk?

Never	Rarely	Sometimes	Often	Always

Q3.6 When you used the pedal desk, how long did you use the pedal desk for?

0-49 minutes	50-99 minutes	100-149 minutes	>150mins

Q3.7 - Please read the following statements and indicate how important this factor was in your decision to use a pedal desk.

Q3.8 I tried the pedal desk because I wanted to change up my studying environment / method.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.9 I tried the pedal desk because I was curious.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.10 I tried the pedal desk because I understand the benefits exercise has for my mental and physical health.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.11 I tried the pedal desk due the physical discomfort from sitting down for long periods of time.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.12- What are some other factors that motivated you to use the pedal desk?

_____

_____

Q3.13- What are some factors that are preventing you from using the pedal desk more often?

_____

_____

Q3.14 - **If you have not used the pedal desk before, please read the following statements and select the best option that closely reflects your reasoning.**

Q3.15 I did not use the pedal desk because I did not know about the active study stations on campus.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.16 I did not use the pedal desk because I did not know how to use it.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.17 I did not use the pedal desk because I believe it will distract me from my studies.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.18 I did not use the pedal desk because I believe it would be uncomfortable to bicycle in an open area

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.19 I did not use the pedal desk because I think I would be embarrassed bicycling in an in an open area in from on my peers.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.20 I did not use the pedal desk because the machine was already occupied.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.21 I did not use the pedal desk because it is uncommon to use a pedal desk

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.22 - **The Physical Activity Office in partnership with Irving K Barber has recently installed active study stations in the library. This permanent installation includes two pedal desks and an adjustable height desk.**

Now that you've had heard about the active study station at IKB, would you be willing to try the pedal desk?

Yes	No

Q3.23 What would motivate you to use the pedal desk?

_____

Q3.24 What are some internal or external barriers preventing you from using the pedal desk?

Q3.25 Please read the following statements and select the option that best reflects your thinking on why you would consider using pedal desk.

Q3.26 I would like to use a pedal desk because I believe it would improve my mental health and overall mood

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q54- I would like to use a pedal desk because I believe it would improve my physical health.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.27- I would like to use a pedal desk because I believe it will increase my focus and memory.

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.28 - I would like to use a pedal desk because I believe it will decrease my risk for future chronic diseases related to sedentary behaviour (ie. heart disease, Type 2 diabetes, obesity etc ...).

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly Agree

Q3.29 - I would like to use a pedal desk because I think I am at risk of developing chronic disease related to sedentary behaviour (ie. heart disease, Type 2 diabetes, obesity etc …).

Strongly Disagree	Disagree	Somewhat disagree	Neither disagree or agree	Somewhat agree	Agree	Strongly Agree

Q4.1 - This is the end of the survey. Thank you for your time!