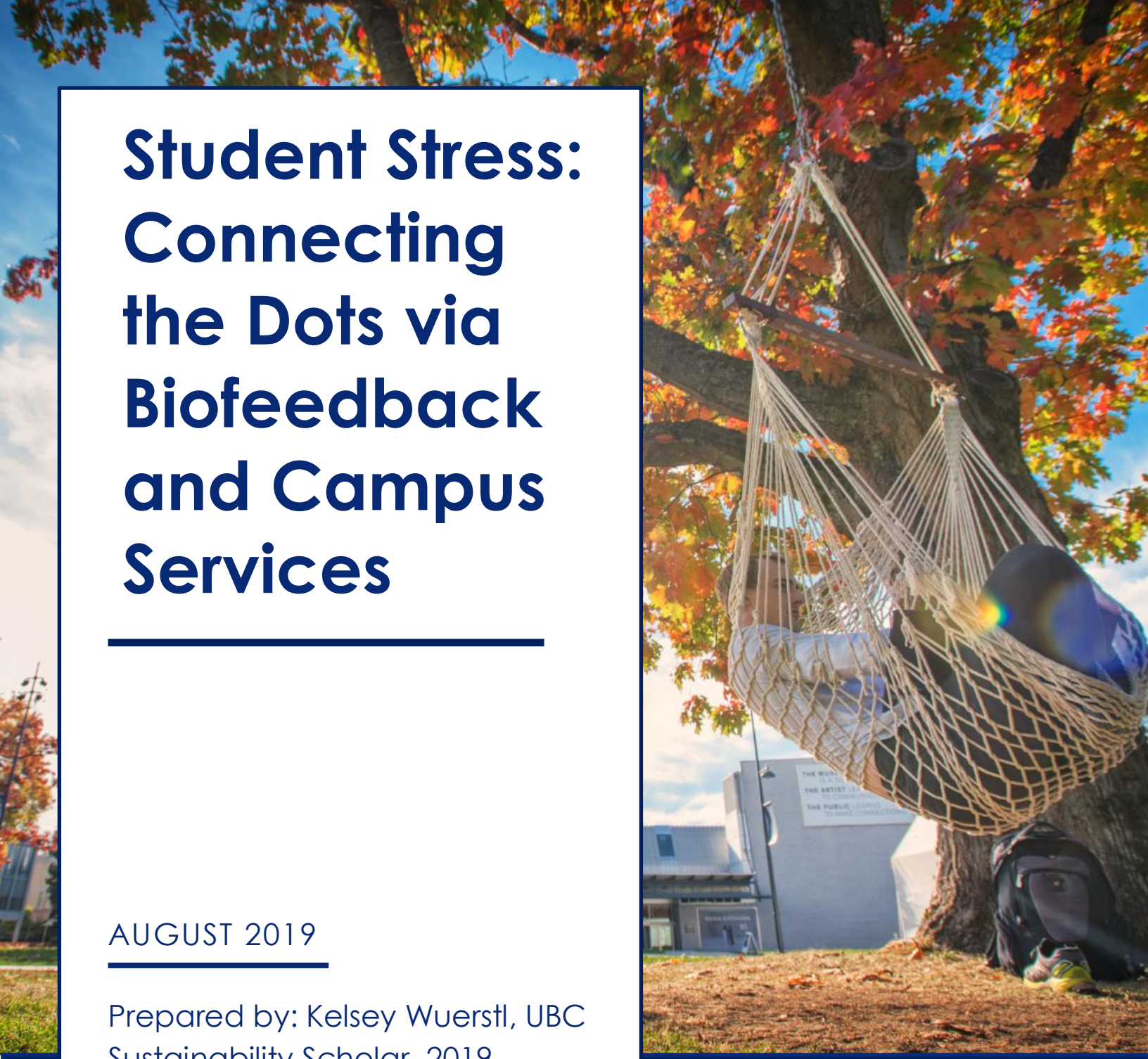

Student Stress: Connecting the Dots via Biofeedback and Campus Services

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Prepared by: Kelsey Wuerstl, UBC Sustainability Scholar, 2019

Prepared for: Dr. Tanya Forneris, School of Health and Exercise Science

SUSTAINABILITY SCHOLARS DISCLAIMER

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organisations in support of providing graduate students with opportunities to do applied research on projects that advance sustainability across the region.

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Executive Summary

Over the last several decades, universities have been faced with the challenge of responding to the rising mental health concerns and chronically elevated levels of stress on campuses. Collectively, the increase in volume and severity of mental health concerns and increase in help seeking behaviour among students has led to an unsustainable demand on the wellbeing and mental health services on campuses. Feasible tools, resources, and programs are urgently needed to ensure wellbeing and mental health services on campuses can continue to support the growing student body seeking support for mental health concerns. This project aims to inform the development of a campus-wide stress management strategy to reduce burden on the wellbeing and mental health services at UBC Okanagan and foster greater resilience among its student body. To accomplish this objective, this project followed three steps: (1) identify resources available at UBC Okanagan and identify evidence-based tools within the literature related to reducing stress among university students; (2) conduct interviews with students to gain a more comprehensive understanding of the barriers and facilitators students encounter to accessing wellbeing and mental health resources; and (3) refine a biofeedback intervention to help students learn to understand and self-regulate their stress response.

The environmental scan revealed a broad collection of resources available at UBC Okanagan, ranging from individual counselling to canine therapy, and will serve as a useful foundation for the development of the campus-wide stress management strategy. Findings from the literature search emphasized app- and web-based tools, programs, and resources as a promising approach for alleviating demand on conventional services and addressing multiple barriers to accessing resources among students. Despite the apparent benefits of app- and web-based service delivery platforms, UBC Okanagan wellbeing and mental health services has limited web- and app-based options to refer students to. Development of app- and web-based resources may be an important area for researchers, intervention developers, and wellbeing positions at UBC Okanagan to target to enhance sustainability of wellbeing and mental health resources on campus and improve help seeking behaviour among students.

However, prior to the development of a behavioural intervention, such as to improve help seeking and resource access behaviours among students, it is crucial to first understand the barriers, facilitators, and current behaviours of the target population. The Theoretical Domains Framework (TDF) provides a theoretical lens from which to explore the contextual factors influencing students help seeking and resource access behaviours. Barriers and facilitators identified through TDF interviews were deductively coded to one of the 14 domains of the TDF and systematically linked to intervention functions and policy categories within the Behaviour Change Wheel (BCW), a theory-informed intervention development tool. Unfortunately, due to unforeseen circumstances, recruitment was delayed, and interviews are currently in progress and anticipated to be completed September 2019. Results of the deductive coding of barriers and facilitators to the TDF and BCW will be synthesized into intervention recommendations for future intervention development.

Analysis of the pilot study informed the refinement of the innovative biofeedback intervention being implemented with peer mentors and their first-year mentees in September 2019. Participants of the pilot study completed eight sessions of biofeedback training, which aimed to improve participant's awareness of their stress response and teach them a breathing technique to self-regulate their stress response. Acute perceived stress, measured on a 10-pt visual analog scale pre- and post-biofeedback and breathing exercise, significantly decreased following six of the eight sessions. Additionally, while the results weren't significant, greater parasympathetic augmentation was observed pre- to post-assessment. These results may indicate that biofeedback interventions are effective at reducing acute feelings of stress, such as those experienced prior to an exam or presentation, and improving control over one's stress response.

In summary, the results from this project suggest that app- and web-based interventions may be a feasible option to improve stress management of university students and alleviate the demand on university wellbeing and mental health services. Specifically, a biofeedback intervention delivered via app- or web-based platforms may be particularly promising as biofeedback uses limited resources and time to teach students a tangible stress management skill. Additionally, greater numbers of students can be reached through app- and web-based platforms and universities benefit from reduced cost, time, and resources.

INTRODUCTION

Background

The transition to university can be notoriously stressful for young adults as they learn to live on their own, manage finances, and keep up with the increased demands associated with university courses. The incidence and severity of mental health concerns, including depression, anxiety, eating disorders, and suicidal ideation, has increased on university campuses over the last several decades, partially due to the chronically high levels of stress observed on university campuses (Bayram & Bilgel, 2008; Eisenberg, Gollust, Golberstein, & Hefner, 2007; Garlow et al., 2008; Ibrahim et al., 2013). Universities have responded to this rising epidemic through the development and implementation of wellbeing and mental health services on campuses to support students struggling with stress and mental health. While the increased availability of services and greater normalization of treatment for mental health concerns has led to an increase in help seeking behaviour among young adults, it has also resulted in an unsustainable demand on university wellbeing and mental health resources (Hunt & Eisenberg, 2010). The 2014 National Survey of Counseling Center Directors reported that 71.7% of directors experienced administration issues due to an increase of students with severe psychological problems, and 69.4% reported concerns around the growing demand for services without appropriate increases in resources (Gallagher, 2015). Numerous interventions varying in content, mode of delivery, theoretical approach, effectiveness, and feasibility, have been developed to relieve this demand. Among the plethora of stress management interventions, feasible options need to be identified to complement and support conventional approaches to ensure the sustainability of wellbeing and mental health services on campuses and ensure optimal treatment for all students seeking support.

Despite the increase in help seeking behaviours on university campuses over the years, it is still reported that relatively few students experiencing high levels of stress or mental health problems report receiving any sort of treatment (Drum, Brownson, Burton Denmark, & Smith, 2009; Zivin et al., 2009). Among students experiencing at least one mental health problem, less than 40% reported receiving any mental health care (Eisenberg, Hunt, Speer, & Zivin, 2011). Therefore, interventions need to not only alleviate demand on conventional mental health and wellbeing services on campus, they also need to address student barriers to help seeking. Students often describe stress as a normal part of the university experience, which was identified as one of the most common barriers to seeking help from mental health and wellbeing services (Downs & Eisenberg, 2012; Ibrahuim et al, 2013). Additional barriers to seeking help included a preference for dealing with stress alone, not seeing their need as serious, and not having

time for treatment (Downs & Eisenberg, 2012). While these studies provide preliminary insight on a few barriers encountered by students when seeking help, they lack a theoretical approach from which a theory-based intervention, program, or resource can be developed to effectively address these barriers. Prior to developing an intervention, program, or resource it is crucial to understand the behaviour and the contextual factors influencing the behaviour, or intervention designers risk developing an intervention that fails to show an effect or has the opposite effect than intended (Michie, Atkins, & West, 2014).

The Behaviour Change Wheel (BCW), a theory-based intervention design tool developed from a synthesis of 19 frameworks of behaviour change, recommends using the Theoretical Domains Framework (TDF) to conduct interviews to understand the behaviour in context and identify what is likely needed to change for the desired behaviour to be performed (Atkins et al., 2017; Michie, van Stralen, & West, 2011). As shown in Figure 1, the TDF is comprised of 14 domains: knowledge; skills; social influences; social/professional role and identity; memory, attention, and decision processes; environmental context and resources; beliefs about capabilities; beliefs about consequences; optimism; behavioural regulation; goals; intentions; emotions; and reinforcement. The TDF provides a theoretical lens through which view the cognitive, affective, social, and environmental factors influencing behaviour (Atkins et al., 2017). Identified barriers and facilitators are coded to one of the 14 domains, which have been systematically linked to the Capability-Opportunity-Motivation Behaviour (COM-B) model of the BCW (Michie et al., 2011; Michie et al., 2014). Together, the COM-B model and TDF specify sources and determinants of behaviour to target to bring about a change in the desired behaviour. Student behaviour around seeking help and accessing resources on university campuses needs to be investigated before interventions, programs, and resources can be developed and implemented to optimally support students and alleviate demand on conventional counselling and psychotherapy approaches.

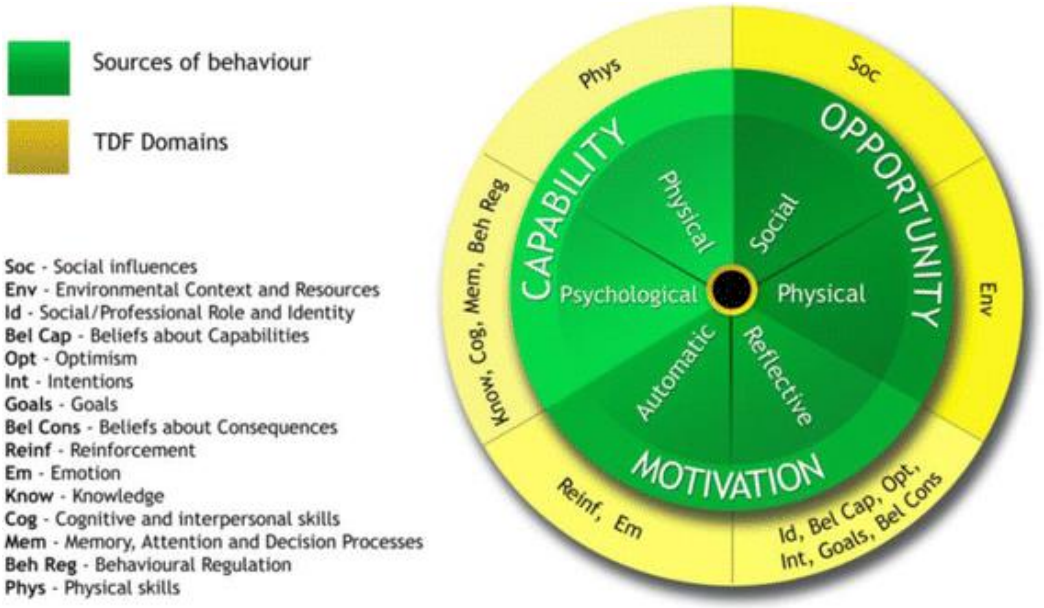

Figure 1. Theoretical Domains Framework Mapped Against COM-B Components (Source: Atkins et al., 2017)

Objective

The overall aim of this project is to inform the development of a comprehensive strategy for improving stress management on campus. This was accomplished through three main objectives:

1. Identify resources on campus and evidence-based tools in the literature related to reducing stress among university students;
2. Understand the barriers and facilitators students encounter to accessing wellbeing and mental health resources; and
3. Refine an innovative biofeedback intervention to help students learn how to self-regulate their stress response.

ENVIRONMENTAL SCAN & EVIDENCE-BASED TOOLS

Environmental Scan

UBC Okanagan offers diverse wellbeing and mental health resources through the Health and Wellness Center, including individual counselling, group counselling, workshops, links to apps as well as additional online resources. In addition to a number of resources and programs, outside the office of Health and Wellness, to support student wellbeing (e.g., Workshops through the Student Experience Office, B.A.R.K program, THRIVE week). A current challenge is having a collective understanding of all of these resources, from which the foundation of a comprehensive stress management plan can be developed. It is critical to identify and understand supports already in place before developing new supports to avoid redundancy, misuse of time and resources, and overlooking important gaps in resources. This section offers a brief overview of the primary resources already available on campus. Refer to Appendix A for a complete listing of the resources available through the Health and Wellness Center's website.

The counselling services offered through the Health and Wellness Center follow a stepped care counselling model, which aims to maximize the effectiveness of limited mental health services based on the needs of all students (Cornish et al., 2017). The stepped care model is a flexible structure that is shown to be particularly valuable in university and college settings where demand outweighs supply (Reetz et al., 2014), as treatment resources can be allocated equitably, rather than equally, based on individual student need. The counselling services at UBC Okanagan utilise a four-step approach.

UBC Okanagan's Four-Step Counselling Approach:

1. **Initial visit:** Determine the student's needs and priorities and identify potentially helpful resources.
2. **Campus and personal self-care:** Equip the student with a range of community, campus, and online resources.
3. **Groups and workshops:** Enable the student to build peer support through groups and workshops.
4. **Individual counselling:** Provide individual counselling to students requiring greater levels of support.

This stepped care approach encourages students to explore self-help resources to promote greater resilience and mental wellness, which alleviates demand on conventional counselling services. Qualified counsellors provide resources and support

for students on a variety of issues including academic pressures, relationship and friendship difficulties, mental health, and work-life balance.

In addition to the face-to-face counselling services offered directly through the Health and Wellness Center, students at UBC Okanagan also have access to *EmpowerMe*, a 24/7 telephone and online crisis support and counselling service. *EmpowerMe* supports the existing on-campus and *StudentCare* mental health resources through the provision of additional supports to contribute to the growth of a resilient student community. Students may connect with qualified counsellors, consultants, and life coaches via 24/7 helpline, the *EmpowerMe* website, or mobile app. The various service-delivery platforms offer students flexibility, anonymity, and greater accessibility to self-manage stress and mental health concerns.

Peer support programs offered through the Student Experience Office are a feasible complementary service to conventional counselling services. New UBC Okanagan students have the option to be paired with an upper-year student of the same academic program through the Peer Mentor Program. Research has found that first-year students paired with an upper year peer report better academic performance (Rodger & Tremblay, 2003), greater sense of belonging (Glaser, Hall, & Halperin, 2006), and greater satisfaction with university (Sanchez, Bauer, & Paronto, 2006), than first-year students without support from an upper-year peer mentor. UBC Okanagan peer mentors support first-year students through weekly emails detailing campus events and opportunities designed to foster a sense of belonging on campus; tips and tricks for making the most of university; and information about resources and departments to help students thrive. First year students often face an array of challenges, but experienced peer mentors can help first years find the right resources and supports to face challenges and champion growth.

Canine therapy, a specific form of animal-assisted therapy (AAT), is offered on campus through the B.A.R.K (Building Academic Retention through K-9's) program. Interactions between university students and trained therapy dogs and handlers aims to reduce stress, lessen feelings of homesickness, cultivate interpersonal connections, and promote social-emotional wellbeing of students. Students have the option to sign up for intervention studies, where they are paired with a therapy dog and provide pre-, post-, and follow-up measures; or attend a drop-in session, where dogs are brought to campus to reduce stress for various members of the university community. The B.A.R.K program offers a feasible wellbeing and mental health support service that is shown to improve psychological wellbeing through decreases in perceived stress, homesickness, and increased affinity for the campus (Binfet, 2017).

Additional support services students can be connected to through the Health and Wellness Center include art therapy (UBCO Art Hive) and mindfulness (SMART Program). Art therapy offers students a creative outlet through which to de-stress. Brief art breaks and creative outlets, such as colouring and drawing sessions have been shown to reduce test anxiety and improve mindfulness among university students (Carsley & Heath, 2019). Daily mindfulness programs, including the SMART (Stress Management and Resiliency Techniques) program, aim to improve mental and physical health through healthy habits of the mind to promote happiness.

Identification of Evidence-Based Tools

To identify evidence-based tools, a broad search of the literature was conducted. The search strategy used terms focused on "university", "interventions", and "stress reduction". The search was limited to studies published within the last five years to ensure recency and novelty of the interventions, as well as feasibility of the project. Interventions were included if they were app- or web-based interventions, biofeedback interventions, animal assisted therapy (AAT), or peer-led interventions. Counselling-based or psychotherapy interventions, which are typically time and resource intensive, were excluded as this study aimed to identify interventions and resources to alleviate the unsustainable demand on current university mental health and wellbeing resources. This review of the literature was exploratory in nature and aimed to gain a better understanding of the stress management resources and interventions already out there. Therefore, results reflect a general summary and cursory interpretation of identified resources, with a focus on the potential feasibility and acceptability of identified interventions.

The literature review identified numerous university-based stress management interventions. The following sections focus on app- or web-based interventions, biofeedback interventions, animal assisted therapy, and peer-led interventions as they exhibit promising effectiveness and are likely to be the most feasible and sustainable options to be implemented on campus as they require few resources, minimal time, and no certified psychologist or counselor.

App- and Web-Based Interventions

App- and web-based interventions hold promise as an alternative to conventional counselling and psychotherapy approaches as they offer users anonymity, 24/7 availability, reduced costs, and tailored delivery (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). Students may

find them particularly appealing as they are flexible and highly accessible, enabling time restricted students to set their own schedule for using these resources. Universities may benefit from the reduced costs associated with office rent and utilities; reduced cost, time, and resources required in hiring or training psychologists or facilitators; and reduced burden on staff resources (Berger, Boettcher, & Caspar, 2014; Griffiths et al., 2006; Richards et al., 2014; Titov et al., 2011).

One hundred and fifty students with elevated levels of stress from a German university completed *StudiCare Stress*, an internet-based intervention focused on improving problem-focused coping and emotion regulation to improve stress management (Harrer et al., 2018). *StudiCare Stress* was derived from GET.ON, a web-based stress management intervention for employees. The eight essential online modules were supplemented with elective modules; a personal stress and mood diary app; and were guided by eCoaches through online platforms. Modules incorporated components of cognitive-behavioural problem-solving strategies to improve problem-focused coping. Perceived stress, depression, anxiety, and emotional exhaustion all exhibited significant improvements immediately post-intervention and 3-months post intervention. Additionally, interviews were conducted with 10 participants of the *StudiCare Stress* intervention (Fleishmann, Harrer, Zarski, Baumeister, Lehr, & Ebert, 2018). Participants highlighted that the web-based intervention was efficient, flexible, and used a familiar platform. They also noted the benefit of not having to try and book an appointment with a counsellor on campus. Modules that required less time were identified as being more helpful as they required less planning and changing of schedules. App- and web-based interventions should focus on providing brief modules/sessions to reduce participant burden, time conflicts, and improve retention.

Two universities in the United States implemented an intensive online cognitive training program, Lumosity, for university students (Bettis et al., 2017). Participants completed thirty 15-20-minute online sessions involving various games and activities aimed at improving working memory, attention control/inhibition, and shifting/cognitive flexibility over five weeks. Cognitive training coaches tracked participant's progress and scheduled weekly phone calls to discuss progress. Different from the Harrer et al. (2018) study, the online intervention was compared to a 6-week in-person coping skills intervention aiming to teach students coping skills and stress management. Both interventions reported reduced stress, improved executive functioning, and reduced anxiety post-intervention, highlighting the effectiveness of the online intervention compared to a conventional intervention. Coping and stress management skills may be effectively taught through online platforms, and yield similar

improvements in stress, anxiety, and executive function as more traditional education and counselling style interventions.

While many studies utilizing an online platform are time and resource intensive, there have been resource-minimal studies that have reported decreases in stress and anxiety. A pilot study in the United States found an online self-guided mindfulness meditation course significantly improved mindfulness, perceived stress, and state and trait anxiety in participants who completed approximately 8-minutes per day of mindfulness meditation (Burgstahler & Stenson, 2019). The intervention was adapted from the Palouse online Mindfulness-Based Stress Reduction (MSBR) Meditation website, which provides educational and informational introductions to the practice of mindfulness meditation. Meditation videos, between 5 and 12 minutes long, were posted online daily Monday through Friday for 8 weeks. The intervention highlights that interventions need not be intensive, or counselling based, to help students reduce stress. Improved mindfulness was seen in participants who reported an average of 2 minutes of mindfulness meditation a day, with a greater number of minutes of meditation associated with greater improvements in mindfulness as well as stress and state and trait anxiety.

With the increased use and popularity of smartphones, app-based interventions are becoming increasingly common. Undergraduate students at a Canadian university who participated in a four-week app-based mindfulness intervention reported reduced trait anxiety, and improved general health, energy, and emotional wellbeing (Lee & Jung, 2018). Participants completed the core plan of *DeStressify,* a mindfulness app, which entailed audio, video, and text files focussed on grounding visualization, gratitude, imagining the life you want, and finding meaning. The files were 3-23 minutes in length and participants were instructed to use the app five days a week for four weeks. The study highlighted that findings were encouraging considering the need for assessible alternative mental health management tools and services as it can easily be incorporated into support services and used in addition to other mental health support services.

Broadly, app-based and web-based interventions are shown to be as helpful as conventional standards of care for reducing stress and are well accepted among university students. App- and web-based interventions offer a service-delivery platform that can be effectively used for a wide range of intervention content including mindfulness (Gluck & Maercker, 2011; Morledge et al., 2013, Lee & Jung, 2018), cognitive-behavioural therapy (Radhu, Daskalakis, Arpin-Cribbie, Irvine, & Ritvo, 2012), and acceptance-based therapy (Ahtinen et al., 2013).

Take Home Points:

1. Feasible for a wide array of intervention content.
2. Reduced cost and resources for universities.
3. Greater accessibility and flexibility for students.

Biofeedback Interventions

Stressful situations produce physiological changes in heart rate, heart rate variability (HRV), blood pressure, and breathing rate (Chrousos and Gold, 1992; Jarczok et al., 2013). Biofeedback interventions aim to address these physiological changes by providing individual's with skills and techniques to improve awareness and voluntary control over their real-time physiological responses to stress. Advancements in technology, such as smartwatches, have made biofeedback interventions more feasible for the general public (Ratanasiripong, Sverduk, Hayashino, & Prince, 2010). A recent review by De Witte, Buyck, & Van Daele (2018) on the psychological and physiological effects of combined biofeedback and stress management interventions reported preliminary evidence of improvements in physiological and psychological indicators of stress following a biofeedback intervention and highlighted the feasibility of biofeedback interventions for stress management.

Fourteen university students participated in a biofeedback intervention aiming to improve HRV during stressful situations (Whited, Larkin, & Whited, 2014). *HeartMath Institutes emWave* PC Stress Relief System provided participants with real-time visual feedback of their heart rate, HRV, and coherence. Participants completed between 4 and 8 sessions depending on how quickly they achieved <50% low coherence. Throughout the intervention, participants were instructed to practice the techniques learned on their own time for 10 minutes a day and during any stressful situations. The intervention group exhibited higher pNN50 during stress relative to the control group, which may indicate increased parasympathetic augmentation, or less parasympathetic withdrawal, in response to stress. However, the study reported limited treatment effects by increasing HRV during exposure to stress and commented on the need to determine what physiological changes are clinically meaningful.

An eight-week brief biofeedback intervention conducted with 44 first year psychology and nursing students from a Portuguese university reported significant decreases in stress and anxiety in the biofeedback treatment group compared to the control group (Chalo, Pereira, Batista, & Sancho, 2017). During the weekly 15-minute sessions, participants were instructed to sit quietly,

focus on positive thoughts, and follow a constant pace of 6 breaths per minute as indicated by the breath bar of the Biofeedback 2000 x-pert software. The participants were instructed to use the slow respiration rate and positive thoughts whenever they experienced anxiety in daily life. In addition to reducing student stress and anxiety, this intervention had good acceptability as weekly sessions were 15 minutes in length reducing the likelihood of scheduling conflicts and time restraints.

Changes in perceived stress, state and trait anxiety, and affective states were assessed in thirty-seven students following a single session of each: paced-breathing with biofeedback, self-paced walking, and quiet study (Meier & Welch, 2015). Sessions were 50 minutes long with the specified condition (paced-breathing, walking, and quiet study) lasting 10 minutes. The paced-breathing with biofeedback condition involved two 4-minute diaphragmatic breathing exercises in which participants followed a breathing pacer set at six breaths per minute. During the self-paced walking condition, participants walked on a treadmill for 10 minutes at a self-selected pace. Results suggest a moderate-sized reduction in state anxiety immediately and 15-minutes post paced-breathing with biofeedback condition compared to the self-paced walking and quiet study control conditions. Additionally, the paced-breathing with biofeedback condition reported immediate improvements in calmness. This study highlights that an acute bout of paced-breathing can ameliorate anxiety to allow students to focus on the task at hand with a calm disposition, better than a mild physical activity intervention such as self-paced walking.

A recent study expanded on the findings from Meier and Welch (2015) through the comparison of a 4-week heart rate variability coherence biofeedback (HRVCB) training intervention to a 4-week high-intensity interval training (HIIT) condition to examine the effects on school burnout – an outcome of chronically elevated stress levels (May, Seibert, Sanchez-Gonzalez, & Fincham, 2018; Salmela-Aro, Kiuru, Leskinen, & Nurmi, 2009). Participants in each condition attended three 20-minute weekly sessions. The HRVCB condition received training on stress reduction techniques and biofeedback technologies. Participants practiced a breathing technique aimed at improving their coherence using the *HeartMath Institute's emWave 2* biofeedback system and were encouraged to practice the breathing technique on their own time. The HIIT condition performed ten 60-s intense cycling bouts (90% HR_{max}) interspersed with 60-s of rest. Results of the study suggest that individuals in the HRVCB group compared to the HIIT group had significant reductions in school burnout, blood pressure, and mathematical computation errors following the intervention. This study, while being short at only four weeks long, required participants to come in three times a week, which may not be feasible for some students with heavier

course loads, part- or full-time jobs, and other time commitments on top of their schooling.

In short, biofeedback interventions may serve to alleviate demand on university wellbeing and mental health services through the provision of biofeedback and breathing techniques that students can use to cope with test anxiety (Prato & Yucha, 2013), public speaking and presentations (Kim, Kim, & Jung, 2012; McKinney & Gatchel, 1982), and increased feelings of stress throughout the day. While facilitators are still required to teach students the biofeedback technique, the necessary resources and time to train facilitators is substantially less than those required for other conventional methods such as cognitive-behavioural therapy. Furthermore, training sessions can be delivered in as little as 15 minutes, broadening the number of students that can be reached. Biofeedback interventions may offer universities a sustainable option to stress reduction on campus as it equips students with a tangible skill to self-manage feelings of distress.

Take Home Points:

1. Students learn a tangible skill for stress management.
2. Training sessions can be delivered in 15 minutes.

Animal-Assisted Therapy

Animal-assisted therapy (AAT) is increasingly been used to provide support and comfort to individuals who are ill or experiencing stress in hospitals, schools, nursing homes, and airports. Recent years have seen an increase in AAT on university campuses as a complementary therapeutic approach to conventional counselling and psychotherapy services. AAT may address the help seeking barriers of lack of time for treatment and preferring to deal with stress alone (Downs & Eisenberg, 2012), by offering students single session counselling (Hymmen et al., 2013), and a walk-in approach, as opposed to scheduling an appointment (Stalker et al., 2016). Additionally, McGill University emphasized that the therapy dog program on its' campus was inexpensive, not time consuming, and well-received by students (Lannon & Harrison, 2015), which may relieve some of the demand experienced by conventional wellbeing and mental health services on campus.

The Building Academic Retention through K-9's (B.A.R.K) program provided drop-in canine therapy as a complementary wellbeing and mental health support program to students at a Canadian university (Binfet et al., 2017). Students who attended a B.A.R.K drop-in session completed a pre- and post- self-assessment of their stress. Sessions ran for 90 minutes once per week over three semesters and students choose when and for how long they attended sessions.

Participant's post-session stress levels were significantly lower compared to pre-session stress levels. Due to the drop-in structure of the B.A.R.K program, follow-up stress levels were not collected. While this study lacks findings on the potential long-term effects, it highlights the beneficial psychological effects a single 30-minute canine therapy session has on reducing perceived stress among university students.

An Animal Visitation Program (AVP), in which students interacted with shelter dogs and cats as opposed to trained therapy animals, compared salivary cortisol levels between four conditions: (1) interaction with program animals, (2) observing others interacting with program animals, (3) viewing a slideshow of program animals, and (4) waitlist (Pendry & Vandagriff, 2019). Salivary cortisol was collected upon waking and pre and post 10-minute condition. Participants assigned to the brief 10-minute hands-on condition exhibited significantly lower levels of salivary cortisol post-test compared to the observation, slideshow, and waitlist conditions. In addition to the psychological benefits related to stress reduction, AVP's may be effective at reducing physiological markers of stress as illustrated through the lower salivary cortisol levels observed in the hands-on condition of the above AVP.

As a whole, AAT may be a favourable complementary approach to stress reduction on university campuses as they enable students to self-manage stress through a walk-in structure and requires a minimal time commitment, as improvements in physiological and psychological indicators of stress have been observed in as little as 10-35-minute interactions. Additionally, large numbers of students can access the sessions at once, which may provide relief to the over-capacity conventional wellbeing and mental health services.

Take Home Points:

1. Walk-in structure eliminates the need for appointments.
2. Large numbers of students can be reached at once.

Peer-Led Interventions

Peer-led, or peer support programs, are common on university campuses as they are shown to improve help seeking behaviour and suicide perceptions, increase social integration, improve academic retention, and reduce anxiety among adolescents and young adults (Campbell & Campbell, 1997; Ferrari, 2004; Ruthkosky & Castano, 2007). Students who do not perceive their need as serious enough for professional help (Downs & Eisenberg, 2012) or have negative expectations of professional help (Czyz, Horwitz, Eisenberg, Kramer, & King, 2013) may be more likely to seek out help from

peers through an informal peer support program.

Students attending a group peer-support program at a university in the United Kingdom reported significant increases in mental wellbeing following the completion of the program (Byrom, 2018). The peer-mentors were primarily individuals with experience of living with depression as the program was targeted to students experiencing symptoms of depression. Mentees attended workbook guided weekly sessions for six weeks. Mentees were encouraged to reflect on successes, discuss challenges, brainstorm solutions with others in the group, and write out implementation intentions regarding managing stressful situations in daily life. Group peer support programs, while still resource and time intensive, require less facilitator training than conventional counselling and psychotherapy which often require clinical psychologists. For example, peer mentors were trained in student mental health, active listening skills, introductory motivational interviewing, boundaries, and safeguarding over two-days – substantially less time than the training required for conventional counselling and psychotherapy approaches.

Peer support interventions are encouraging support services in addition to conventional wellbeing and mental health services as they require less facilitator training and resources. Additionally, students experiencing stress and mental health concerns may benefit from the vicarious experience that is provided through peer support and may be more comfortable discussing concerns with a peer than a professional they have no connection with.

Take Home Points:

1. Students may be more likely to seek support from a peer than a professional.
2. Reduced facilitator training costs, time, and resources.

BARRIERS AND FACILITATORS TO ACCESSING RESOURCES

Methods

To investigate barriers and facilitators to accessing resources on campus, semi-structured TDF interviews are being conducted with 10-12 students to gain a better understanding of the barrier's students encounter to accessing wellbeing and mental health resources on campus. Development of the interview guide was informed by previous qualitative studies using the TDF (Weatherson, McKay, Gainforth, & Jung, 2017) and guidelines for using the TDF to investigate implementation options (Atkins et al., 2017). To promote a discussion of student's lived experience around stress and accessing resources on campus, broad, open-ended questions were used. Additional open-ended questions tailored to the TDF domains allowed for exploration of the barriers and facilitators students encounter when accessing resources on campus. See Appendix B for full interview guide.

Professors were contacted for permission to recruit from their courses during the second term of the 2019 summer semester. Individuals who expressed interest in participating were contacted to schedule an interview at a time and place most convenient to them. All interviews will be conducted in person and audio-recorded and transcribed for qualitative analysis.

Interview transcripts will be deductively analyzed using the TDF. Barriers and facilitators will be extracted in duplicate by two independent coders. Factors that promote accessing wellbeing and mental health resources on campus will be coded as facilitators and factors that impede accessing wellbeing and mental health resources on campus will be coded as barriers. The identified barriers and facilitators will be independently coded to one of the 14 domains of the TDF by two independent coders.

Due to unforeseen delays, interviews are currently in the process of being conducted and are anticipated to be completed end of September 2019. Interviews were meant to be co-conducted with two new wellbeing positions at UBC Okanagan. However, the hiring process for these positions were delayed and they did not end up being hired until July, which resulted in a delay in recruitment. In addition, approval for ethics modifications, which entailed modifying the consent form and email and classroom script took longer to complete than anticipated. These factors combined delayed when interviews with students could be started.

Expected Results

Numerous studies have aimed to understand barriers to help seeking behaviour among university students in an effort to improve utilization of wellbeing and mental health services on university campuses (Czyz et al.,

2013; Downs & Eisenberg, 2012; Marsh & Wilcoxon, 2015; Miranda, Soffer, Polanco-Roman, Wheeler, & Moore, 2015). Commonly reported barriers to help seeking include not seeing one's need as serious enough (Czyz et al., 2013), cost or perceived cost of treatment (Marsh & Allen, 2015; Miranda et al., 2015), public, perceived, and self-stigmatizing attitudes to mental illness (Gulliver, Griffiths, & Christensen, 2010), and lack of time for treatment (Miranda et al., 2015). It is anticipated that UBC Okanagan students will not differ greatly from previously student samples and will report similar barriers as those mentioned above. Conversely, due to the comprehensive nature of TDF interviews, in that it uses behaviour change theory to assess both personal and systemic factors related to performing a behaviour, it is also speculated that important novel barriers may be unveiled. Relatively few studies use theory to understand barriers to help seeking behaviour among university students, and among those that do (Czyz et al., 2013), it appears to be applied to study rationale and methods design in a variable and unsystematic manner, which may reduce effectiveness of future interventions informed by these studies (Michie et al., 2014). The interview data currently being collected will expand on the previous work around barriers to help seeking among university students as it will provide a theoretical basis from which future theory-based interventions may be systematically developed to enhance utilization of wellbeing and mental health services among students experiencing mental health concerns.

As this project ultimately aims to contribute to the development of a strategic, campus-wide stress management plan, it is paramount that the identified barriers and facilitators be linked to a theory-based intervention design tool, such as the BCW. The BCW provides evidence-based matrices for linking behavioural determinants (as identified through TDF coding of barriers and facilitators) to sources of behaviour (COM-B model), and from there to nine intervention functions and seven policy categories from which an intervention may be developed (see Appendix C for the BCW and associated matrices) (Michie et al., 2011). Following the deductive analysis of the interview transcripts, relevant intervention functions and policy categories will be synthesized into intervention recommendations. These intervention recommendations will then be evaluated on their apparent feasibility using Michie et al.'s (2014) APEASE criteria, which assesses recommendations on their **A**ffordability, **P**racticability, **E**ffectiveness, **A**cceptability, **S**afety, and **E**quity. The derived intervention recommendations will contribute to the strategic campus-wide stress management plan to break down barriers to accessing resources as they will be used to inform the development and implementation of future theory-based interventions to improve utilization of wellbeing and mental health resources on campus.

REFINEMENT OF A BIOFEEDBACK INTERVENTION

Methods

The pilot study entitled *Academic resilience in post-secondary education: Using an innovative biofeedback approach to help students to learn how to self-regulate their stress response* was run prior to the start of this Sustainability Scholars project. However, to ensure clarity of the analysis, the methods of the pilot study have been included in this report. In fulfillment of her role as a Sustainability Scholar, KW completed the analyses of the qualitative and quantitative data to inform the refinement of the biofeedback intervention to be implemented with peer mentors and their first-year mentees in September 2019.

Peer mentors from UBC Okanagan's Peer Mentor Program were recruited to participant in the pilot study for the randomized control trial in September 2019. Refer to Table 1 for participant characteristics. The eight peer mentors will be the facilitators of the biofeedback training in September 2019. The pilot study allowed the peer mentors to gain a first-hand understanding of the training their mentees will experience in the fall. Participants completed eight sessions of biofeedback training and a pre- and post-assessment. Two research assistants conducted all training sessions and participants completed all sessions with the same research assistant in an effort to foster a positive, respectful, and trusting relationship. Each biofeedback training session was comprised of a short lifestyle questionnaire and two 4-minute breathing exercises using *HeartMath Institutes emWave Pro* software. The lifestyle questionnaire assessed factors which could influence heart rate including stress levels, sleep quality; food, beverage, and substance intake; and physical activity. The *emWave Pro* software provides real-time feedback of HRV – the variation over time of the period between consecutive heartbeats (Acharya, Joseph, Kannathal, Lim, & Suri, 2006), and coherence – a state of psychological and physiological synchronization characterized by a smooth, sine-wave like pattern in HRV (McCraty, 2005). Participants were equipped with a small earlobe sensor from which heart rate was measured and displayed on screen as HRV and coherence. Coherence was expressed through three coloured bars: red (low coherence), blue (moderate coherence), and green (good coherence) (see Figure 2). The coherence bars provided participants feedback on the stability and regularity of their breathing and the synchronization between heart rhythm and breathing.

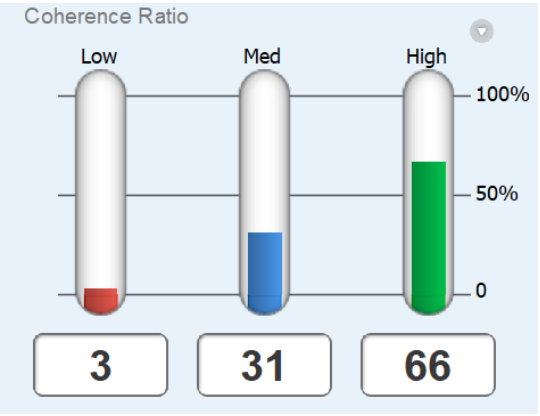

Figure 2. Coherence Bars (Source: *HearthMath emWave Pro*)

Prior to the start of the first exercise, the research assistant gave standardized instructions on the breathing technique, which entailed focusing and breathing through the heart or chest area and focusing on a positive emotion such as appreciation or calmness. Participants were encouraged to breath as smoothly and evenly as they could while following the breath pacer in each exercise as this would increase the likelihood of achieving good coherence and hence, greater HRV. The first exercise, *The Coherence Coach* (see Figure 3), required users to follow a wave-like breath pacer set at six breaths per minute.

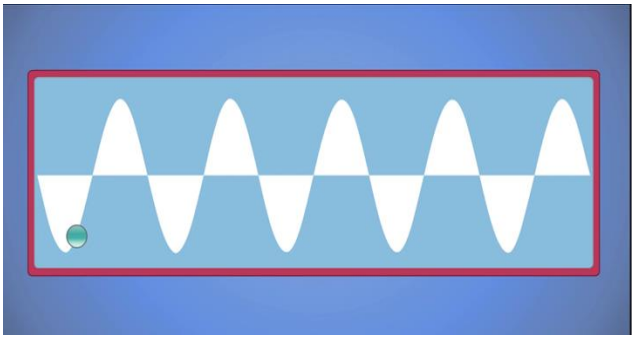

Figure 3. Coherence Coach Exercise (Source*: HeartMath emWave Pro*

The second exercise had users follow a mandala breath pacer (see Figure 4), which entailed a coloured ring that increased and decreased in size at a rate of six breaths per minute.

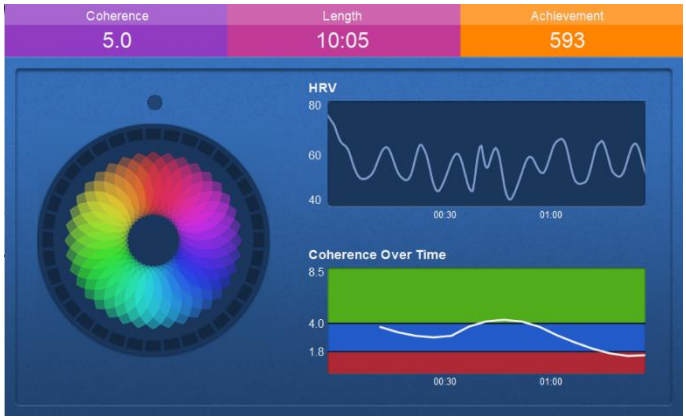

Figure 4. Mandala Breathing Exercise (Source: *HeartMath emWave Pro*)

Completion of both breathing exercises took eight minutes, with the whole session lasting 15 minutes. Participants attended sessions twice a week for four weeks. Following completion of the post-assessment, participants completed a follow-up interview to assess their experiences of the training and determine possible areas of improvement.

Table 1. Participant Characteristics (N=8)

VARIABLE		M (SD)	N (%)
Gender			
	Male		3 (37.5)
	Female		5 (62.5)
Age (yr)		22.6 (4.6)	
No. of Courses		4.1 (1.8)	
Year of Study		3.6 (0.7)	

Measures

Perceived Stress. The Perceived Stress Scale (PSS) was used to measure participants perceived stress levels. The PSS is a widely used validated measure that includes 10 items which assess how unpredictable, uncontrollable, and overloaded individuals find their lives are (Cohen, Kamarck, & Mermelstein, 1983). Participants are asked to rate their feelings and thoughts regarding items related to current stress levels on a 5-pt Likert scale. Higher scores indicate greater levels of perceived stress. Additionally, participants self-reported their perceived stress, on a scale of 1 to 10, prior to and immediately following the 8-minute breathing and biofeedback exercises.

Academic Resilience. The Academic Resilience Scale-30 (ARS-30) was used to assess an individual's ability to maintain high levels of academic motivation and success despite adversity (Cassidy, 2016). Participants read a short excerpt exemplifying significant academic adversity and were instructed to imagine that they were the student in the excerpt. They then respond to 30 items around how they would react to and manage certain aspects of situation on a 5-point Likert Scale. Higher global scores reflect greater academic resilience.

Grit. The Short Grit Scale (Grit-S) is a validated and efficient measure of trait-level perseverance and passion for long-term goals (Duckworth & Quinn, 2009). A confirmatory factor analysis supports delineation of the Grit-S into two subscales: Consistency of Interest and Perseverance of Effort. The Grit-S consists of 8-items and is psychometrically stronger than the original 12-item measure of grit (Duckworth & Quinn, 2009). Participants are asked to respond to

statements based on how they think they compare to most people in the world. Higher scores are indicative of greater "grittiness" among individuals.

Mindset. Mindset was measured using the 8-item Implicit Theories of Intelligence Scale (Dweck, 2013). The scale assesses respondent's beliefs about the fixedness vs. malleability of intelligence. Participants are asked to rate the extent to which they agree with each statement from "Strongly agree" to "Strongly disagree". Higher scores reflect a greater belief that intelligence is malleable.

HRV Assessment. During the eight-minute HRV assessment, participants were asked to sit quietly and breathe normally. The *HeartMath emWave Pro* earlobe sensor was attached to the participants ear of choice. Participants were asked to close their eyes or look around the room (i.e. away from the screen) to avoid receiving feedback on their heart rate during the assessment. Components of HRV, including high and low frequency heart rhythm bands and coherence, were collected over the 8-minute assessment period. *HeartMath's emWave Pro* software delineates heart rhythm into four primary frequency bands: high frequency (HF), low frequency (LF), very low-frequency (VLF), and ultralow frequency (ULF). HF and LF correspond to parasympathetic and sympathetic activity, respectively. Frequencies between 0.04 Hertz and 0.15 Hertz are considered low frequencies, whereas frequencies between 0.15 Hertz and 0.4 Hertz are considered high frequencies. Low frequency/high frequency (LF/HF) ratio was also used in the analysis as it provides an approximate indication of sympathetic to parasympathetic activity. Normalized coherence was also analyzed. Higher coherence scores reflect greater stability and regularity of an individual's heart rhythm frequency.

Qualitative Measures. All participants were invited to complete an interview following the post-assessment. Interviews were audio-recorded and conducted by the participants respective research assistant. The aim of the interview was to gain a better understanding of their experiences in the program. Questions focused on aspects of the program that participants liked and disliked; areas that could be improved; and how, if at all, the training had impacted their daily life, studies, and ability to cope with stress. Please refer to Appendix D for the full interview guide. As no formal analysis was conducted with the interview data, interviews were not transcribed. Interview recordings were reviewed and informed the refinement of the biofeedback project.

Statistical Analysis

Pilot data were analyzed using Statistical Package for the Social Sciences (SPSS) version 24 (IBM Corp). Data were screened for missing and impossible values and outliers. If less than 5% of data was missing, mean values replaced missing values. Impossible values were replaced with mean values and identified outliers were winzorized. Reverse

scoring was performed for appropriate items of the PSS, ARS-30, Grit-S, and Implicit Theories of Intelligence Scale and global scores for each scale were calculated. Within-subjects t-tests were employed to assess changes in perceived stress, grit, academic resilience, and mindset. Additionally, within-subjects t-tests were used to assess changes in self-reported perceived stress pre- and post-eight-minute breathing exercise for each of the eight sessions. In regard to the HRV data, within-subjects t-tests were used to assess changes in HF, LF, HF/LF ratio, and normalized coherence.

Results

Quantitative Analysis

All eight participants completed all eight biofeedback training sessions and the pre- and post-assessment. Within-subjects t-tests were conducted to assesses changes in perceived stress, grit, and mindset following an eight-session biofeedback intervention. As seen in Table 2, PSS scores decreased from pre- to post-assessment, however the decrease was not statistically significant *(t = .29, p = .78)* and yielded a small effect size (*d=.07*). Additionally, Consistency of Interest decreased non-significantly (*t=1.43, p=.20*) from pre- to post-assessment, while Perseverance of Effort increased non-significantly (*t=-1.14, p=.29*) with small-to-moderate effect sizes (*d=.33* and *d=.42*, respectively) (See Table 2). And finally, mindset scores increased following the eight biofeedback training sessions, however the change was not significant *(t=-.23, p=.82)* and had a small effect size (*d=.10*) (see Table 2). In interpreting these results, it is important to note that we may have been underpowered to detect a change as indicated by the small sample size (*n=8*).

ARS-30 scores could not be analyzed as we were unable to accurately determine total scores. The author of the ARS-30 must be contacted to receive permission to use the scale and receive the guidelines for scoring the ARS-30. However, the research team was unable to contact the author of the ARS-30 to receive permission for use and guidelines for scoring. Therefore, the ARS-30 has been removed from the analysis. Moving forward, while the research team awaits a response from the ARS-30 author, they are looking into other scales to measure academic resilience for the RCT in September.

Results of the within-subjects t-tests comparing perceived stress pre- and post-eight-minute breathing and biofeedback exercises suggest that we can reject the null hypothesis for sessions 1, 2, 3, 4, 5, and 7 and conclude that perceived stress is influenced following eight minutes of breathing and biofeedback. As shown in Table 2, perceived stress significantly decreased following eight-minutes of breathing exercises in sessions 1-5 and 7. Session 6, which was not significantly different, showed decreased levels of perceived stress, similar to the other sessions. However, session 8 showed no change in perceived stress scores. Effect sizes

for sessions 1-7 ranged from small to large with session 6 having the smallest effect size (*d=.14*) and session 1 having the largest effect size (*d=.80*)

As shown in Table 2, results suggest that LF, LF/HF ratio, and normalized coherence were not statistically different from pre- to post-assessment, however, the moderate-to-large effect sizes observed suggest that there may be an effect but that we are underpowered to detect it. LF exhibited a large increase, and although not significantly different, had a moderate-to-large effect size (*d=.72*). HF on the other hand had a relatively small increase with a small effect size (*d=.05*). The LF/HF ratio increased as well, indicating greater parasympathetic activity in relation to sympathetic activity, and had a large effect size (*d=.79*). Normalized coherence showed non-significant improvement from pre- to post-assessment with a moderate-to-large effect size (*d=.68*). Again, it is important to note that we may have been underpowered to detect statistically significant changes as a result of the small sample size (*n=8*).

Despite the lack of differences observed on the PSS pre- and post-assessment, the statistically significant reduction in acute perceived stress pre- and post-eight-minute breathing is an important finding. Teaching students biofeedback and a simple breathing technique may equip them with useful tools that they can use when experiencing high levels of stress at a specific moment in time, such as before an exam or presentation. The breathing technique may increase perceived control over situations and stimuli, allowing students to lower their stress response which may enhance focus and clarity on the task at hand. The finding of reduced acute perceived stress is similar to findings in a study utilizing app-based biofeedback games, which found decreased perceived stress following 30-minutes of biofeedback-based gaming (Dillon, Kelly, Robertson, & Robertson, 2016). The authors suggest that biofeedback games allow users to learn to monitor and hence, control their stress response. It was suggested that as perceived control over a situation or stimuli increases, there is an inhibition in autonomic arousal (Eyesenck, 2013; Leotti et al. 2010), which may manifest as reduced feelings of stress.

It is unsurprising that no changes in the Grit-S and the Implicit Theories of Intelligence Scale were observed pre- to post-assessment (see Table 2) as they are trait-based scales. Traits are conceptualized as being more stable and less likely to change compared to states which are circumstantially dependent and change with time (Salminen, Saarijarvi, Aairela, & Tamminin, 1994). Changes in traits occur over years and decades (Roberts, Walton, & Viechtbauer, 2006), and therefore the short duration of this intervention may limit the potential to detect changes in trait-based scales.

Table 2. Means and SDs for Grit, Mindset, Perceived Stress, and HRV at Pre-Intervention and Post-Intervention, Paired Sample t-Tests, and Pre-Post Effect Sizes (N=8)

VARIABLE		PRE-INT. *M(SD)*	POST-INT. *M(SD)*	*t*	*p*	*d*
Grit						
	Consistency of Interest	11.6 (4.8)	10.1 (4.3)	1.4	.20	.33
	Perseverance of Effort	13.8 (3.0)	14.9 (2.2)	-1.1	.29	.42
Mindset		24.9 (2.6)	25.1 (1.4)	-0.2	.82	.10
Stress						
	Global	19.3 (7.8)	18.8 (7.3)	0.3	.78	.07
	Session 1	6.9 (1.7)	5.4 (1.8)	3.6	.01*	.80
	Session 2	5.8 (2.6)	4.5 (3.0)	3.0	.02*	.44
	Session 3	5.8 (3.2)	4.4 (3.1)	2.8	.03*	.44
	Session 4	5.5 (2.5)	4.8 (2.6)	2.8	.03*	.27
	Session 5	5.4 (1.5)	4.6 (2.0)	3.0	.02*	.42
	Session 6	4.6 (2.1)	4.3 (2.3)	2.1	.08	.14
	Session 7	5.3 (2.9)	4.4 (2.9)	3.0	.02*	.30
	Session 8	4.4 (2.3)	4.4 (2.1)	0.0	1.0	0.0
HRV						
	LF	475.2 (347.0)	955.3 (876.2)	-1.6	.14	.72
	HF	239.4 (301.0)	225.5 (203.7)	0.1	.92	.05
	LF/HF Ratio	2.7 (1.6)	6.5 (6.6)	-1.6	.15	.79
	Normalized Coherence	43.0 (5.9)	52.0 (17.7)	-1.9	.09	.68

Note. INT = Intervention (8 sessions of biofeedback training); LF = Low Frequency; HF = High Frequency; LF/HF = Low Frequency/High Frequency. * denotes significantly different between pre- and post-assessment ($p<.05$)

Qualitative Analysis

Interviews ranged from 16 minutes to 46 minutes in length. In general, participants were supportive of the intervention and noted the acceptability and potential benefits for first-year university students. Participants enjoyed that the breathing exercises took less than 10 minutes – an amount of time that they felt could be reasonably incorporated into everyday life. Prior to the start of the intervention, one participant felt that in order to see any benefit from a breathing or meditation-type intervention, one would have to commit long periods of time every day. Participants liked that this technique was something that could be done virtually anywhere: while studying in the library, during or before an exam, or alone in their room in the morning or evening. Additionally, participants commented that the eight-minutes of sitting and breathing fostered a greater understanding of their own stress response and how stress impacts their life and ability to respond to challenges.

> *"Yeah, you're stressed for this final, but really how big of a difference is this final going to make in your entire life. Cause when I was trying to feel like appreciation [during the breathing exercises] for my family or my friends, and then it's hard to feel like stressed about school when you're just glad that your family and friends are healthy"*

Additionally, participants reported that they enjoyed the consistency and looked forward to coming in each week as it provided an opportunity to slow down and focus on themselves for once. Scheduling time to take care of oneself is often not a high priority for university students as more urgent matters are often at the forefront such as exams and assignments.

> *"And also I feel like there's probably other things that I could or should be doing within that [session] time frame that just seemed a little less important… like it just seemed a little more important to focus on myself. Yeah, so I think that was a benefit just to bring awareness back to the fact that it is important to relax and take care of yourself."*

However, while participants commented on the benefits of the training, most highlighted that they, as upper year students, would likely not use it as they already possess effective stress management and coping techniques. They did believe that first year students (i.e. their mentees in September) would benefit from learning a stress management technique such as this one in the first few months of university.

> *"I think it's almost essential if you're in first year to do [the biofeedback training] in September because you get the students a great stress*

reducing technique [early]. Then when the term actually does get stressful, they can use it."

Interviews yielded mixed results on the acceptability of the two exercises, the *Coherence Coach* and mandala, and appears to primarily be related to personal preference. Due to its inflexibility and "unnatural breathing flow", half of the participants found the *Coherence Coach* to be more difficult to follow and therefore less enjoyable and helpful. The definitive peaks and valleys restricted participants natural breath, with one participant commenting that they felt like they were holding their breath waiting for the breathing pacer to reach the highest and lowest points. Participants felt that the mandala reflected natural breath better due to the ambiguity of the coloured ring's transition from increasing to decreasing and vice-versa which allowed for more flexibility in the transition between inhaling and exhaling.

The other half of the participants found the *Coherence Coach* to be more enjoyable as there was less ambiguity on when to inhale or exhale and they could therefore plan when to transition their breathing. However, despite only enjoying one of the exercises, participants felt that it was beneficial to have both exercises during the training.

In support of the quantitative findings, particularly acute perceived stress, participants noted that they felt less stressed immediately post training but reported that the feeling did not last throughout the day or over the course of the week. This highlights that the biofeedback intervention and the breathing techniques may be a useful tool for managing acute feelings of stress, however, more research is needed to assess the long-term effects of a biofeedback intervention on stress. Despite the lack of prolonged feelings of reduced stress, some participants commented that they felt more energized and awake the rest of the day, especially because the training was often done first thing in the morning and signified the start of the school day.

Table 3. Suggestions for improving the biofeedback intervention based on interview data

ITEM	RECOMMENDATIONS
Scheduling	Having a set schedule (same time every week) plus some flexibility if needed Simple scheduling because students already have busy schedules
Lifestyle Questionnaire	More specificity on food that was consumed (i.e. pre workout) as this can affect heart rate
Instructions at the start of the Coherence Coach	Provide students the option of hearing the instructions after the third or fourth session, or; Shortened set of instructions following the third or fourth session Readability and clarity of instructions (i.e. heart breathing vs. heart focused breathing)
Visual vs. Sound Cues	Sound cues to allow participants to close their eyes during the exercises
Coherence Coach Vs. Mandala	Randomizing which exercise is done first
Outcome Measures	Longitudinally looking at student grades to assess the effect on academic performance

CONCLUSION

Summary

In summary, this project brought several important things to light. First, numerous wellbeing and mental health support services are available on campus and provide a solid foundation from which to build a strategic campus-wide stress management plan. Second, stress reduction interventions that utilize an app- or web-based service delivery platform may be effective for helping students manage and reduce their stress. And third, a brief biofeedback intervention may effectively reduce acute feelings of stress among university students.

UBC Okanagan offers a wide variety of wellbeing and mental health supports ranging from one-on-one counselling to drop in art therapy and canine therapy. The environmental scan highlighted that while students have a range of resources from which to choose, accessibility of these resources may be limited. It was also noted that work is needed on campus to keep students up to date on the variety of resources and decrease the various barriers students may face in accessing such resources. Moving forward, the research team is working closely with wellbeing specialists on campus to expand the environmental scan and identify all resources campus wide, and not just those offered through the Health and Wellness Center. The identified resources will be compiled into a regularly updated and comprehensive document that may be accessed online or given to students seeking help. Additionally, once all resources have been collected, gaps in resources may be identified and interventions to target these gaps and improve student utilization of resources may be developed and implemented on campus.

Findings from the literature review highlight that app- and web-based stress management interventions may be particularly acceptable and feasible in a university setting as these methods of delivery work for a range of intervention content; address some student barriers to help seeking; and alleviate demand on university wellbeing and mental health services. Alternative stress reduction interventions such as mindfulness (Gluck & Maercker, 2011; Morledge et al., 2013) and biofeedback (Dillon et al., 2016) have been successfully delivered via app- or web-based platforms, in addition to more conventional methods such as cognitive-behavioural therapy (Radhu et al., 2012) and acceptance-based therapy (Ahtinen et al., 2013). In addition to using a familiar platform that students are comfortable with, university students enjoy the anonymity, 24/7 accessibility, and flexibility that comes with app- and web-based services (Griffiths et al., 2006; Fleishmann et al., 2018). App- and web-based interventions are often associated with reduced costs as there is often minimal to no facilitator requirements (Burgstahler & Stenson, 2019; Lee & Jung, 2018); and minimal to no need for office or counselling space. Additionally, a greater number of students can be reached and

supported with less staff and resource burden, alleviating much of the demand on counselling services. Numerous successful apps have been developed and tested that could be implemented through UBC Okanagan's Health and Wellness Center, including *DeStressify* (Lee & Jung, 2018) and *StudiCare Stress* (Harrer et al., 2018).

Finally, the analysis of the pilot study revealed that biofeedback interventions aiming to help students to understand and self-regulate their stress may be useful for reducing acute feelings of stress. While participants reported that they wouldn't use a program such as the one used in this intervention on their own, they were highly supportive of the potential effectiveness for first-year students who likely lack coping and stress management skills. Learning a breathing and biofeedback technique may help first year students cope with acute stressful situations like test and presentation anxiety, as well as general feelings of stress associated with the increased academic demands of university courses. However, more research is needed to assess the long-term benefits on stress management, and traits such as grit and mindset. Additionally, a different measure of academic resilience should be used moving forward with this intervention as the ARS-30 is inaccessible.

Based on the collective findings of the literature review and the analysis of the pilot study, future directions of this research should focus on the development of a biofeedback app that utilizes the biofeedback capability of smartwatches or other wearables. Technology is progressing such that smartwatches and other wearables are becoming more widely adopted by the general population due to the increasing affordability of these devices. Biofeedback may be an effective method for stress management as participants learn to control their stress response. However, it requires a trained facilitator, office space, time, and regular in-person meetings. Using an app-based service-delivery platform can circumvent cost and resource barriers experienced by universities and augment acceptability for students who perceive their need as not serious enough for conventional counselling services, or who lack the time and financial resources to access conventional services.

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APPENDICES

Appendix A UBC Okanagan Health and Wellness Center Resource PDF

Mental Health Resources

Stepped Care at UBC Okanagan's Health and Wellness

- In your **first visit with a counsellor**, he/she will meet with you to clarify your current needs and/or goals. With your counsellor's support, you will **develop a plan** to improve your overall well-being.
- An important component of many treatment plans includes **accessing the appropriate resources**. To start, this may include learning more about mental health challenges that are relevant to you through **online and printed educational resources**. As well, this might require incorporating new tools, activities, and strategies into your day in order to promote greater resilience and mental wellness. For some individuals, accessing **campus resources** through professional and/or student staff may improve their personal wellbeing; and in some cases, **workshops and groups** on campus may also be available to address individuals' mental health needs.
- Sometimes **one-on-one support** from a therapist or counsellor is the best fit for your needs and/or goals. If this is the case, many **individual counselling** options in the community and on campus are available.

Educational Resources (Printed and Online)

- ☐ Health and Wellness Website: https://students.ok.ubc.ca/health-wellness/welcome.html
- ☐ Anxiety Canada: http://anxietycanada.com
- ☐ Centre for Clinical Interventions: http://www.cci.health.wa.gov.au/Resources/Looking-After-Yourself
- ☐ Headspace: http://headspace.com
- ☐ Insight Timer: http://insighttimer.com
- ☐ Jack.org: http://jack.org/Home/
- ☐ MindShift App: https://www.anxietybc.ca/resources/mindshift-app
- ☐ Mood Gym:https://moodgym.com.au/
- ☐ MySleepButton App: https://mysleepbutton.com/home/
- ☐ Self-Compassion.org: http://self-compassion.org/category/exercises/

Campus Resources

Academic Coaching

- ☐ Learning Coaches / AIC office: http://students.ok.ubc.ca/advising/learning_support.html
- ☐ Math and Science Centre (MSC): http://students.ok.ubc.ca/academic-supports/msc.html
- ☐ Online Learning Resources: http://students.ok.ubc.ca/learning-supports.html
- ☐ Supplemental Learning (SL): http://students.ok.ubc.ca/academic-supports/sl.html
- ☐ Writing and Research Centre (WRC): http://library.ok.ubc.ca/wrs/wrc/

Peer to Peer Support

- ☐ BARK: http://bark.sites.olt.ubc.ca/
- ☐ Peer Mentor Program: https://students.ok.ubc.ca/peermentor
- ☐ Peer Support Network (PSN): https://www.ubcsuo.ca/services-psn or psn@ubcsuo.ca

Other UBC Okanagan Professional Staff and Services

- ☐ Aboriginal Programs and Services (APS): UNC 212, http://students.ok.ubc.ca/aboriginal/welcome.html
- ☐ Academic Advising: UNC 207, http://students.ok.ubc.ca/advising/welcome.html
- ☐ Athletics and Recreation: http://camprec.ok.ubc.ca/welcome.html
- ☐ Awards and Financial Support: http://students.ok.ubc.ca/finance/welcome.html
- ☐ Career Services: UNC 207, https://students.ok.ubc.ca/careers/services.html
- ☐ Disability Resource Centre (DRC): UNC 214, http://students.ok.ubc.ca/drc/welcome.html

- ☐ Equity and Inclusion Office: UNC 216, https://equity.ok.ubc.ca/
- ☐ International Programs and Services (IPS): UNC 227, http://students.ok.ubc.ca/international/welcome.html
- ☐ Nutrition Education Centre: ARTS 179 https://hes.ok.ubc.ca/nutrition-education-centre/
- ☐ Ombudsperson Office: UNC 217, michael.jud@ubc.ca or (250) 807-9818
- ☐ Student Experience: UNC 329, https://students.ok.ubc.ca/student-experience/welcome.html
- ☐ Sexual Violence Prevention and Response Office (SVPRO): Nicola 120, shilo.stcyr@ubc.ca, (250) 807-9640, https://svpro.ok.ubc.ca/

Groups and Workshops

- ☐ Art Hive: located in the Maple Lounge outside of Health & Wellness. For more info: sophie.vinette@ubc.ca
- ☐ CMHA Groups (Bounce Back, Accepting Our Bodies, etc.): https://cmhakelowna.com/
- ☐ Developing Minds Series: http://students.ok.ubc.ca/student-experience/developingminds.html
- ☐ Lowering Anxiety through Self-Regulation: UNC 335. Exact dates TBD. To register, contact Lois at lois@hansenonline.ca or phone (250) 860-3181
- ☐ Kelowna Mental Health and Substance Use programs: 505 Doyle Ave., (250) 469-7070
- ☐ Student Wellness 101: UNC 316. Exact dates TBD. Call (250) 718-9291 to register
- ☐ UBCO Meditation Group: UNC 328, 12:15pm-12:45pm, Mon-Fri
- ☐ Y Mind (a 7-week wellness program for young adults ages 18-30) For more information: (250) 317-7980 or ymind@ymcaokanagan.ca

One-on-one Support

- ☐ Empower Me (Student Assistance Program): 1-844-741-6389 or www.studentcare.ca
- ☐ Employee and Family Assistance Program (EFAP)
- ☐ Foundry Kelowna: https://foundrybc.ca/kelowna/ (236) 420-2803, foundrykelowna@cmha.bc.ca
- ☐ Private Counselling:
  - BC Association of Clinical Counsellors: http://bc-counsellors.org/counsellors/
  - BC College of Social Workers: https://onlinememberservice.bccsw.ca/webs/bccsw/register/#/
  - BC College of Psychologists: http://collegeofpsychologists.bc.ca/verify/
- ☐ Interior Health Walk-In Counselling: 505 Doyle Avenue, Mon/Wed/Fri 10am – 2 pm
- ☐ Student Care (UBCSUO plan): www.studentcare.ca or 1-877-795-4427
- ☐ Third Space (on- or off-campus): (236) 420-4360 or http://thirdspacemind.ca
- ☐ UBCO Interprofessional Clinic: ASC ground floor, (250) 807-8241; email: ipc.ok@ubc.ca

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Emergency Services (urgent care for safety concerns)

BC Suicide Help Line: 1-800-784-2433
Crisis Line: 1-888-353-2273
Coping with Suicidal Thoughts: http://www.comh.ca/publications/resources/pub_cwst/CWST.pdf
Kelowna Community Response Team: (250) 212-8533; 11:30am-9pm 7 days/week
Kelowna General Hospital Emergency Department: 2268 Pandosy Street
KUU-US Crisis Line (BC) 1-800-588-8717
Lifeline App: www.TheLifeLineCanada.ca
Trans Lifeline: 1-877-330-6366

Additional Resources (as determined by student and counsellor):

- ☐ _____

(Source: https://students.ok.ubc.ca/health-wellness/counselling-mental-health/)

Appendix B Interview Guide: Student Barriers to Accessing Wellbeing and Mental Health Services on Campus

Part A: Consent & Participant ID Code

Introduction: The purpose of this interview is to develop a greater understanding student's experiences with accessing wellbeing and mental health support services on campus. The questions I would like to ask focus on the barriers and facilitators you have experienced around stress management and access to support services on campus. The topics we discuss during this interview will be used to inform the development of a stress management tool-kit or resource for university students at UBC Okanagan.

Interviews are normally audio-recorded, and this simply provides for accurately keeping track of information. Please confirm that you consent to having this conversation recorded.

Your participation in this study is confidential. In order to maintain confidentiality, we will be creating a unique ID code for each participant.

Should you at any time wish to stop, you may do so without consequences to you, and at anytime you should feel free to ask me questions concerning the interview or the study. May we begin?

Purpose	**Question**
Part B: Introductory Questions and Broad Questions	
Participant Demographics	What gender do you identify with? What is your age? Did you come to UBC Okanagan straight out of high school? What year of study are you in? What is your program of study?
Broad Questions about Stress	Tell me a little bit about some of the (sources of) stress students experience throughout a typical semester? What are some ways that students deal with stress and/or stressful times? Tell me a little about how these compare to your experiences with stress and managing stress.
Part C: Barriers to Accessing Resources on Campus	
Broad Questions – B/F	Have you ever accessed wellbeing and mental health resources on campus?

	Barrier: • Accessed resources: What factors, if any, made it difficult for you to access resources on campus? • Not accessed: What currently stops you or has stopped you in the past from accessing resources? **Facilitator:** • Accessed: What factors, if any, made it easier or helped you in accessing resources on campus? • Not accessed: What would help you to access wellbeing and mental health resources on campus during stressful times?
Psychological Capability	What else do you know about the wellbeing and mental health resources on campus available to you? Do you feel you have the necessary information to access the resources on campus? • Yes: How are you aware of the information about resources on campus? • No: What do you feel is needed to improve your awareness and understanding of these resources?
Physical Capability	In terms of your physical skills or abilities, what do you think is required of you to access resources? (give an example) Do you feel that you possess these skills? • Yes – What helped you to acquire these skills, if anything? • No – What would you need to improve your proficiency in these skills?
Physical Opportunity	How do you feel the university environment and/or atmosphere influences your decision or ability to access resources on campus, if at all? • Hinders: How could the environment be changed to better help you access resources?
Social Opportunity	How do the people you interact with on a daily or weekly basis influence your decision or ability to access resources on campus? • If they hinder you, what could they do differently? Do you know of any of your friends who use any of the offered wellbeing and mental health resources on campus? • Yes – What can you tell me about their experiences?
Reflective Motivation	What value do you see, if any, in accessing wellbeing and mental health resources on campus? How confident do you feel in your ability to access resources on campus? • Why?

	• What would help you to be more confident?
Automatic Motivation	How do your emotions (such as stress, worry, excitement, fear, etc) influence your decision to access resources? • Positive feeling – What makes you feel positively about accessing resources? • Negative feeling – what makes you feel negatively about accessing resources? What, if anything, makes you more likely to access resources on campus? • Yes - Do these motivate you in anyway?
Final Questions	Do you have any other feedback on how to improve students' use of wellbeing and mental health resources on campus? Is there anything else you would like to add about your experiences around managing stress as a university student?

Appendix C Behaviour Change Wheel and Associated Matrices

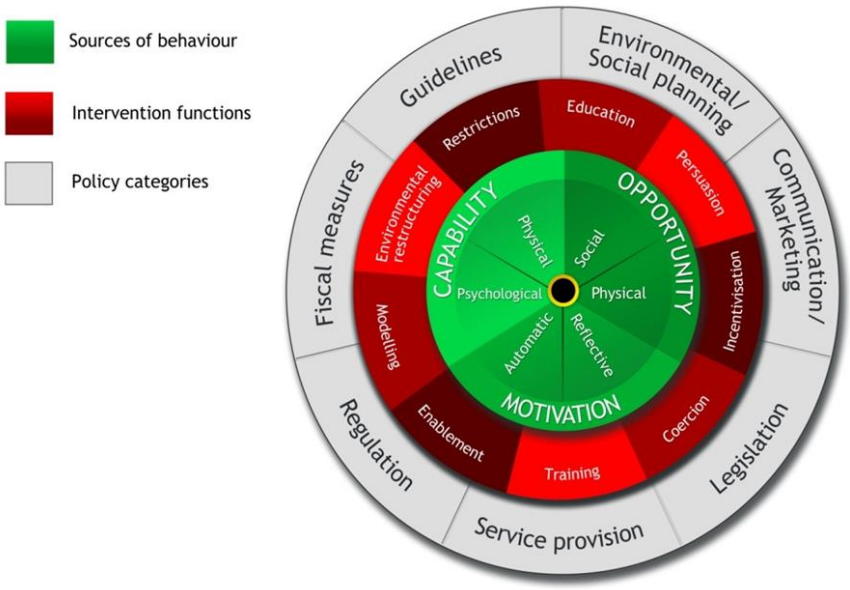

Figure 5. The Behaviour Change Wheel (Source: Michie et al., 2011)

	Intervention functions								
	Education	Persuasion	Incentivisation	Coercion	Training	Restriction	Environmental restructuring	Modelling	Enablement
Physical capability					■				■
Psychological capability	■				■				■
Physical opportunity					■	■	■		■
Social opportunity						■	■	■	■
Automatic motivation		■	■	■	■		■	■	■
Reflective motivation	■	■	■	■					

Figure 6. COM-B Components Mapped Against Intervention Functions (Source: Michie et al., 2014)

	Policy categories						
	Communication / marketing	Guidelines	Fiscal measures	Regulation	Legislation	Environmental/ Social planning	Service provision
Education	■	■		■	■		■
Persuasion	■	■		■	■		■
Incentivisation	■	■	■	■	■		■
Coercion	■	■	■	■	■		■
Training		■	■	■	■		■
Restriction		■		■	■		
Environmental restructuring		■	■	■	■	■	
Modelling	■						■
Enablement		■	■	■	■	■	■

Figure 7. Intervention Functions Mapped Against Policy Categories (Source: Michie et al., 2014)

Appendix D Interview Guide: Participant Experience and Feedback on Pilot Study

Part A: Introduction and Consent

This overall aim of this study is about enhancing academic resilience among undergraduate students by increasing their ability to cope with stress. The primary aim of study thus far has been to pilot the biofeedback training with potential peer mentors who will help facilitate the study in the new school year. The questions I would like to talk about deal with your experience with the biofeedback training and how you feel this training could be improved for you as the peer mentor and for your mentees. Your participation in this study is strictly confidential. Interviews are normally tape-recorded, and this simply provides for accurately keeping track of information. Subsequently the tape will be destroyed. Your participation in this study is important. However, should you at any time wish to stop, you may do so without prejudice to you, and at any time you should feel free to ask me questions concerning the interview or the study. May we begin?

Part B: Participant Experiences and Feedback

1. Tell me in general about your experience with the biofeedback training you just participated in?

2. What are some things you enjoyed about the training?

3. What did you not like or would change about the training?

4. There were two breathing activities. Coherence coach which you practiced for 4 minutes and the Mandela for 4 minutes.
    a. Was one more challenging than the other?

    b. Which did you prefer? Why?

    c. Would you recommend keeping both in but vary the time? Increase time on one while decreasing time on other? OR Only engage in one of the activities for the full 8 minutes?

5. Thinking about the protocol of each practice training session - did you like having the full explanation of the heart focus, heart breathing, heart feeling at the start of every session?

    a. Was is it too repetitive?

    b. What would you recommend changing?

6. What did you learn about yourself from the training? (e.g., stress response, heart rate, breathing etc)

7. Did you find it helpful in relation to decreasing your immediate stress levels (in the moment)? In what ways?

8. Did you find it helped your stress level beyond just within training session (e.g., later the same day, the next day, anytime between your sessions?

9. Do you do any type of breathing exercises on your own outside of the training?

    a. What did you use if anything (e.g., app, music, sitting quietly).

    b. Did you do these types of activities before starting the study or did the study prompt you to practice more breathing exercises?

    c. How and when did you use these?

10. If you had access to this program or a similar app, would you practice breathing activities outside of the training? Why or why not?

11. Do you think this type of training program would be helpful to university students? For what reasons?

12. What would you change about the training program?

13. In the Fall we hope that you will be delivering this intervention to mentees.
    a. Are you still interested in doing this?

    b. What do you need to feel confident to do this?

    c. Do you think the process of scheduling the sessions that was used would work for you in the Fall – e.g., identifying two times during the week that work in your schedule (e.g., reminder they will work with 2 mentees at a time)

14. Is there anything else you would like to comment on in regards to the biofeedback training itself or becoming a leader in the Fall? Do you have any questions at this point?

Thank you for coming and participating in this study. You have been very helpful, and I really appreciate you taking time out of your busy schedule to participate. As a thank you the research team would like to give you this gift card for Starbucks. Additionally, in the fall we will be doing a draw among all the peer mentors for a larger gift card of your choosing.