EVALUATING AN ONLINE, SELF-ADMINISTERED STUDENT WELL-BEING AND RESILIENCE PROGRAM

by

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Abstract

Intro: Post-secondary students need accessible, high-quality e-mental health services now more than ever. Q-Life is an evidence-informed, online, self-directed well-being and resilience program that is highly accessible. The purpose of this project is to evaluate the online well-being and resilience program for post-secondary students called Q-Life to make data-driven recommendations for program development. **Methods:** 424 post-secondary students with pre to post Q-Life assessment data were grouped across engagement levels, program versions, and COVID-19 impact. Subgroup comparisons of effectiveness and reach were made. The relationship between engagement, logged lifestyle behaviours, and mentalities and self-reported well-being scores were investigated. Engagement was compared across demographic groups and program versions. **Results:** A sign test and two-way mixed factorial ANOVAs showed that Q-Life was effective with improvements of 8-10% in well-being and resilience scores (i.e., Q-Life Experience Score) across time for all subgroups of program version and COVID-19 impact. Engagement was weakly associated with well-being scores from Time One (T1) to Time Two (T2), but there was no discernible dose effect. Logged lifestyle behaviours and mentalities were not predictive of T2 well-being scores. Participants were mostly Caucasian and female. **Discussion:** There are many practical implications to be gleaned from the evaluation of Q-Life for Q-Life specifically, and for e-mental health program development and research in general. This evaluation served as a reminder of the importance of conscientiousness in collection of demographic data, engagement data, and self-monitoring data. Baseline well-being and resilience was most predictive of T2 scores which underscores the importance of meeting participants where they are and targeting systemic influencers of well-being and resilience. **Conclusion:** E-mental health programs such as Q-Life show potential for easing the strain on the mental healthcare system, but there is still room for improvement in reaching marginalized populations and monitoring effectiveness if we are to meet the CSA Group's 'National Standard' of Post-Secondary Student Mental Health.

List of Abbreviations

2SLGBTQ+	Two-spirit, Lesbian, Gay, Bisexual, Trans, Queer, Plus other identities
ANOVA	Analysis of Variance
BHM-20	Behavioural Health Measure – 20 ®
COVID-19	Coronavirus Disease 2019
CSA Group	Canadian Standards Association Group
MANOVA	Multiple Analysis of Variance
MHCC	Mental Health Commission of Canada
PSSI	Post-secondary Student Stress Index
QES	Q-Life Experience Score
Q-Life	Quality Life Skill Building experience program
SC2.0	Stepped Care 2.0
SG1A	Subgroup 1A: V1 Q-Life completed before COVID-19
SG1B	Subgroup 1B: V1 Q-Life completed across COVID-19
SG1C	Subgroup 1C: V1 Q-Life completed all during COVID-19
SG2A	Subgroup 2A: V2 Q-Life completed before COVID-19
SG2B	Subgroup 2B: V2 Q-Life completed across COVID-19
SG2C	Subgroup 2C: V2 Q-Life completed all during COVID-19
SG3A	Subgroup 3A: V3 Q-Life completed before COVID-19
SG3B	Subgroup 3B: V3 Q-Life completed across COVID-19
SG3C	Subgroup 3C: V3 Q-Life completed all during COVID-19
T1	Time One
T2	Time Two
V1	Version One
V2	Version Two
V3	Version Three
VA	Version A
VB	Version B
VC	Version C

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Chapter 1: Introduction

Post-secondary education provides many new academic, professional, personal, and social challenges for students (Linden et al., 2017). Too often, students experience psychological distress from these challenges and miss the growth, benefits, and opportunities associated with higher education. From 2016 to 2019, students reported more often feeling hopeless, lonely, very sad, overwhelming anger, and overwhelming anxiety (American College Health Association, 2016, 2019). Over 60% of Canadian post-secondary students felt "more than average" or "tremendous" stress (Mental Health Commission of Canada, 2020). Half of Canadian post-secondary students feel so depressed it is "hard to function" (Mental Health Commission of Canada, 2020). Of concern, 16% of post-secondary students have seriously considered suicide (Mental Health Commission of Canada, 2020).

Students' struggles with mental health tend to carry over into academic performance. In 2009 – 2010 there was a 210% increase in dropout rates in students experiencing mental health problems (Marsh, 2017). In 2019, students experienced negative impacts on their academics (e.g., lower grades and disruptions to academic work) due to stress, anxiety, depression, sleep difficulties, concern for a troubled friend, and other factors relating to mental health (American College Health Association, 2019). Fewer students are engaging in mental health-protective behaviours such as meeting the Canadian physical activity guidelines and eating sufficient fruits and vegetables (American College Health Association, 2016, 2019). High performing, motivated honours students are also likely to struggle with mental health and wellbeing (Cuevas et al., 2017).

Demand for traditional campus counselling grew by 30% between 2009-10 and 2014-15; students seeking help have come to outnumber counselling staff 1,737 to 1 (Winerman, 2017). Student affairs officers' time is dominated by student mental health and well-being concerns 91-94% of the time (Jaschik, 2020). The effects of a student mental health crisis are evident on post-secondary campuses nationwide.

Although this mental health crisis is not new [Farnsworth, 1990, as quoted by (Kumaraswamy, 2013)], the COVID-19 pandemic has exacerbated existing gaps and revealed new struggles. The already strained healthcare system is overwhelmed by the influx of individuals needing support (Copeland et al., 2021; Scharmer et al., 2020; Wathelet et al., 2020); however, the COVID-19 pandemic has also presented an opportunity for development of new strategies to be employed. Technologies have the potential to ease the strain on the mental healthcare system that relies heavily on resource-intensive services. Since around 2003, there has been a rise of persuasive technologies, particularly mobile apps, focusing on systems to aid and motivate individuals to adopt positive behavioural changes (Orji & Moffatt, 2018). The development of standardized evaluation criteria for mobile app quality (the Mobile App Rating Scale, MARS; Stoyanov et al., 2015) and potential for behaviour change research (ABACUS; McKay et al., 2019) revealed a gap in the current market. For example, many innovative technologies in mental health interventions fail to address wellbeing and focus on the pathos side of mental health (Mental Health Commission of Canada, 2021c). Current technology typically employs a static, non-adaptive approach that is inadequate in sustaining health behaviours associated with psychological wellbeing and resilience. Available technologies do not address the need for a scalable, sustainable, whole-health solution. To address the mental health challenges exacerbated by COVID-19, we need to provide innovative solutions that are responsive to users' individual and changing needs, effectively triage them to appropriate resources, and that work in concert with existing resources.

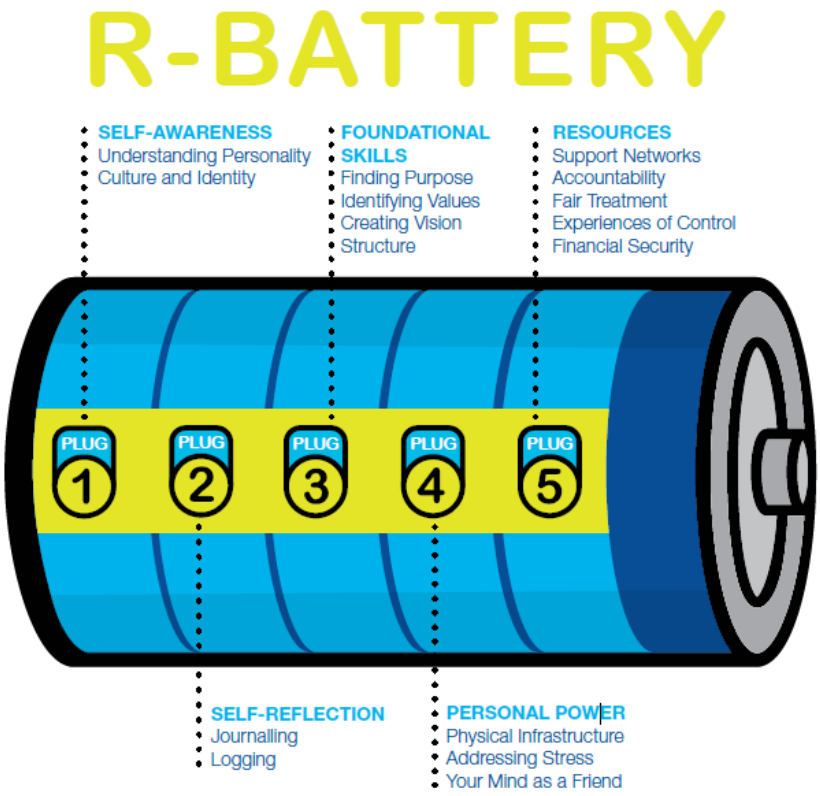
Q-Life and the Present Study

The current research investigated the effectiveness of a behaviour-change, e-mental well-being experience called Quality Life Skill-building Experience Program (Q-Life) by Jackhabbit Inc. Q-Life is an evidence-informed modular, self-directed training program which utilizes educational videos, relatable expert and student interviews, skill-building workbook activities (the companion), journaling, logging, mood tracking, and intermittent self-assessments (the Q-Life assessment of resilience and well-being) to

address several constructs and behaviours that are important in resilience and well-being. Content and behaviour change strategies embody an amalgamation of individual-level behaviour change theories (e.g., planned behaviour and reasoned action theories) and practical techniques (e.g., 'cognitive behavioural therapy' and 'acceptance and commitment therapy'. That said, Q-Life does not abide to any one theory in particular. Q-life does however, address sources of behaviour (capability, motivation, and opportunity) by educating, training, and empowering students in well-being and resilience-related concepts and health behaviours. Q-Life addresses capability through self-monitoring, self-awareness, and self-efficacy. Q-Life addresses motivation through evaluation of barriers, development of purpose and vision, discussing accountability, and self-reflection of values. Q-Life addresses opportunity through reflection on social and environmental influence, structuring of daily and weekly activities, by encouraging exploration of available infrastructure. Figure 1 pictorializes the Q-Life curriculum using the resilience battery model reflective of the program theme of "charging resilience for well-being". Q-Life operationalizes the most effective and desirable behaviour change strategies such as self-reflection (via journaling) and self-awareness (via behaviour monitoring, i.e., logging) as well as the effective but underrepresented strategies such as planning for barriers and restructuring one's environment to be more supportive (Alslaity et al., 2022). Q-Life aims to increase students' awareness, mental health literacy, and self-efficacy in well-being and resilience factors and to reduce stigma associated with engaging in mental health and wellness development.

Figure 1.

Elements of the Q-Life Curriculum



Note. Each 'plug' is a Q-Life module, with 5 modules covering a total of 16 lessons. Each lesson has video lessons and skill-building activities and is represented in the Q-Life assessment of well-being and resilience.

When registered for the Q-Life program, students completed an instructional video for completing a baseline assessment. From this assessment, several scores were derived. Two such scores were the post-hoc scores called the Q-Life Experience Score (QES) and the Q-Life Experience Score Common (QES Common). Once the student completed their baseline score, they could work through instructional and educational videos, answer 10 lifestyle behaviour and mentality logging questions, complete a knowledge and skill-building activity in the workbook called the companion, and journal their thoughts and feelings. The video content (which followed the modules from figure 1) was dosed at one video per day whether the student accessed the video or not. The workbook companion was freely accessible at any time and included one-page readings

on the topics listed in figure 1 and occasional activities where students could put what they learned into practice of resilience-related skills. The journaling and logging were also freely accessible at any time. Students were encouraged to log and journal as much as was possible, if not daily. Should a student have followed the recommended timeline, they would have completed a post-assessment approximately one month following their first engagement with the program. The post-assessment implementation was limited due to the online platform that Q-Life was delivered from called Kajabi (Kajabi.com, n.d.). Kajabi is a subscription-based platform that allows content creators like Jackhabbit Inc. to create and deliver online courses. Within Kajabi, students could only complete the assessment when Jackhabbit Inc. reset the assessment for all participants. This means that the assessment timeline was variable somewhat by student, but was typically completed in approximately one month. Kajabi also allowed Jackhabbit Inc. to administer the Q-Life video, logging, and journaling content; monitor engagement with the program; and provide the companion workbook for students to download. Jackhabbit Inc. collected all the program evaluation data used in the present study through Kajabi.

Q-Life by Jackhabbit Inc. has the potential to be a key resource for post-secondary institutions as they work to implement the National Standard for Mental Health and Well-being for Post-secondary Students (the 'National Standard'; Canadian Standards Association Group, 2020). What makes Q-life able to support post-secondary institutions in upholding the 'National Standard' is the fact that it is evidence-informed, scalable, cost-effective, resource minimalistic, and safe. Furthermore, Q-Life is designed to integrate with the gold-standard Stepped Care 2.0 (SC2.0) resource distribution framework and fill the lower levels of SC2.0 that are presently under-served by the e-mental health industry and holding institutions back from achieving the 'National Standard'. Being online and predominantly automated, Q-Life can service a great number of students whose troubles can be remedied with minor intervention, thereby freeing up access to care for students needing more intensive mental health services. Q-Life can allow for those who require more intensive intervention and expertise to

receive help in a timelier, more consistent manner. Development of such resources as Q-Life – that incorporate evidence into practice, harmonize with SC2.0, and are focused on holistic well-being - will drive the uptake of the 'National Standard' across post-secondary institutions in Canada and beyond. Q-Life development involves ongoing evaluation of program outcomes. The present study is one such evaluation. The results of this study will inform the ongoing development and implementation of the Q-Life program (and e-mental health programs more broadly) across several implementation contexts, including the current COVID-19 pandemic.

Study Purpose, Research Questions, and Hypotheses

The purpose of this project is to evaluate the online well-being and resilience program for post-secondary students called Q-Life to make data-driven recommendations for program development.

The primary research question in fulfilling this purpose was to determine whether Q-Life was effectively improving student well-being and resilience (the outcome for which was called Q-Life Experience Score or QES). Effectiveness is defined as "the impact of an intervention on important outcomes, including potential negative effects, quality of life, and economic outcomes." (Glasgow et al., 2019). Given that negative effects, quality of life, and economic outcomes were not included in the secondary data for the present study, impact was defined exclusively by important outcomes of the targeted constructs of well-being and resilience. Well-being and resilience were indicated within the Q-Life Experience Score (QES) which was derived from the Q-Life validated assessment (Koppernaes et al., 2021) and was measured at baseline and after approximately one month of Q-Life participation. Effectiveness was also evaluated by comparing a subset of the QES (called QES Common) over time. The QES Common is described in detail in the methods section.

The secondary research question was regarding influencers of the program effectiveness. This research question was dependent on the first research question having statistically significant results. It was important to fully understand why Q-Life

might be effective and whether there was a connection between Q-Life engagement and participation in various elements of Q-Life to well-being and resilience outcomes.

Equally important in fulfilling the research purpose was determining for whom Q-Life was effective. Hence, analyses were done to determine whether different subgroups responded differently to the Q-Life program via the well-being and resilience outcome of QES. There were three versions of the Q-Life program for which data was collected; the second version was an evolution of the first and the third an evolution of the second. The program version formed three sub-groups in the data. As well, the emergence of the COVID-19 pandemic during Q-Life implementation and data collection presented a serendipitous and unique opportunity to investigate new subgroups and compare those who completed Q-Life before a pandemic and those who completed during. Hence, the tertiary research question involves findings across sub-groups of program versions and COVID-19. Additionally, there was a question who the Q-Life was reaching and who was participating in Q-Life. Reach is defined as the "absolute number, proportion, and representativeness of individuals who are willing to participate in a given initiative, intervention, or program" (Glasgow et al., 2019). Reach of a health program is an important element to understand and evaluate in implementing effective health programs (Glasgow et al., 1999; Holtrop et al., 2021; RE-AIM.org, n.d.). Due to a technical error in implementation, the most novel Q-Life iteration used the same assessment as the oldest Q-Life program version rather than the newer assessment iteration. This technical error created the opportunity to compare two versions of the Q-Life program that had different content but the same assessment. The content in the most novel Q-Life version was designed to reach and be inclusive for a more diverse audience. Hence, demographic data could be used along with the same QES to understand the representativeness of gender and race demographic groups across program versions.

To summarize, the research questions for this study were:

1. Is Q-Life effective at helping students with pre to post improvement in well-being and resilience?
2. Does level of engagement influence the effectiveness of the Q-Life program and/or does participation in elements of the Q-Life program related to Q-Life outcomes?
3. Are there differences in effectiveness across program version or COVID-19 subgroups and were there any differences in demographic reach across program versions?

Regarding the first research question, it was hypothesized that students would improve QES from pre to post. It was also hypothesized that Time One (T1) to Time Two (T2) QES Common (a subset of QES items) changes would mirror the QES changes across time because the common items across Q-Life versions were selected due to their theoretical importance in operationalizing well-being and resilience.

Regarding the second research question, there were several hypothesized influencers of Q-Life effectiveness. Firstly, it was hypothesized that there would be a dose-response, in that higher engagement with the program would lend to greater Q-Life effectiveness in terms of pre to post change in QES. Secondly, the literature emphasizes the importance of engaging in and monitoring healthful behaviours in well-being and resilience so, it was hypothesized that where wellness-related lifestyle behaviours (i.e., physical activity, sleep, hydration, and nutrition) and positive "mentalities" (i.e., emotional intelligence, stress management, and goal-awareness) were logged more often, there would be an impact on effectiveness (i.e., higher QES pre-post). This impact would theoretically mean that the logged healthful behaviours and positive mentalities would predict T2 QES more than just the baseline QES.

Regarding the third research question, it was hypothesized that each version of the Q-Life program would be effective, but there may be differences in magnitude of effectiveness for different versions. Where V2 and V3 were theoretically "refined"

versions of the V1 Q-Life program, it was predicted that participants of these groups would have greater improvements in QES over time. The sudden and drastic changes of the COVID-19 pandemic and decrease in population well-being were predicted to be reflected in group comparison of COVID-19 and non-COVID-19 groups at baseline testing. It was hypothesized that those who participated in Q-Life during the pandemic may join the program with a lower baseline QES than those who did not. Where literature often shows that those who need intervention the most have the greatest capacity for improvement, it was hypothesized that the COVID-impacted group may exhibit greater change in QES because of the program. Another hypothesis around the third research question was that due to different implementation approaches with different versions; there could be an effect of the 'incentives' (i.e., bonus marks or class marks) that may motivate participants to engage and adhere to the program. The incentivization differences across program versions may impart greater participant engagement and, indirectly, participant reach and outcomes. It was hypothesized that greater incentives would influence engagement, which would produce a greater Q-life outcomes. Moreover, content changes designed to be more inclusive of various demographics groups may lead to greater engagement from non-female and non-Caucasian participants across program versions (specifically, V3 from V1).

More details as to how these analyses and sub-groups will be used to answer these research questions will follow in chapter 3, the methods section of this thesis.

Outline of the Thesis

This research is organized across six chapters. Chapter 1 introduced the present thesis. The mental health crisis faced by post-secondary students prior to and during the COVID-19 pandemic was briefly described. Then, a novel e-mental health tool called Q-Life designed to support students' well-being and resilience was outlined to prepare the reader for its evaluation.

Chapter 2 reviews the literature around mental health, well-being, and resilience as these are the primary targets that Q-Life aims at supporting and are hence critical to

understand for the evaluation of Q-Life. This chapter also provides context to the larger picture of post-secondary student well-being and health behaviour interventions and their distribution to shine light on where Q-Life fits into mental healthcare.

Chapter 3 provides details to the research methodology used to answer the research questions posed in Chapter 1. It begins with descriptions of the data, the variables, and the outcomes that were used and targeted in the thesis. Chapter 3 also shines some light on how the data was collected and how Q-Life was implemented as is relevant to the evaluation of Q-Life's effectiveness and reach.

Chapter 4 presents the results of the quantitative analyses used in the present thesis in the order of the research questions.

Chapter 5 summarizes the results as they relate to the initial hypotheses around the research questions. Chapter 5 also goes into detail about what the results mean in the evaluation of Q-Life and how the data answers the three primary research questions.

Chapter 6 summarizes the results as they relate to the initial research questions the hypotheses around them. Chapter 6 concludes with specific recommendations that can be extracted from the evaluation of Q-Life as they relate to Q-Life and health behaviour interventions in general.

Chapter 2: Review of the Literature

Researcher Worldview and Approach

The researcher has a pragmatic worldview and believes that diverse types of data best provide a more complete understanding of a research problem. That said, it is more methodologically congruent to take a post-positivist worldview in the analysis of the quantitative data that is available to the researcher in the present study.

Introduction

Following an outline of the methodological approach to reviewing the literature, this review delves into the current state of post-secondary student mental health. Next, the mental health crisis in post-secondary students is discussed. Key concepts of mental health, well-being, and resilience are defined before theoretical frameworks and approaches to behaviour change intervention. Finally, online interventions and frameworks for delivering them to post-secondary students are explored, along with the advantages and shortcomings of the state of the art. The current literature review does not include in-depth coverage of condition-specific treatments or services specific to mental illness. While there are many studies focused on this important area, the present study is distinct in that it takes a salutogenic lens to mental healthcare. 'Salutogenesis' is the term coined around 1979 by stress and coping researcher Aaron Antonovsky in his effort to convey a shift in his mode of thinking away from pathogenesis and toward exploring what makes people healthy (Mittelmark & Bauer, 2017). Salutogenesis is a concept aligned strongly with Martin Seligman's positive psychology, and, by extension, constructs such as mental health, well-being, thriving, and resilience. (Mittelmark & Bauer, 2017). This literature review also focuses on post-secondary students due to the nature of the mental health intervention that is examined in the present study. Online (i.e., electronic, telehealth, web-based, or internet-based) interventions for post-secondary students are the focus of the present literature review because this area of well-being and resilience research is on the rise in North America and, again, for congruence with the present study.

Method of Literature Review

Peer-reviewed publications were obtained through Novanet, Google Scholar, CINAHL, Psych Info, and PubMed. In these search engines and databases, searches for articles of relevance and interest were refined using Boolean operators "AND/OR" and truncation and proximity symbols "*" and "N3" respectively. Such specifications were applied after a broader review of search result using combinations of keywords. Keywords like "telemedicine," "online," "post-secondary," "student," "mental health," "well-being," "thriving," "flourishing," and "resilience" were used in various combinations. Where possible (in research databases), the search field was restricted to the title or abstract of peer-reviewed publications. Additionally, statistics and grey literature shared by prominent health "authorities" were hand-picked directly from websites. Such authorities included The World Health Organization, The Mental Health Commission of Canada, The Canadian Mental Health Association, Health Canada, and the Canadian Standards Association (CSA) Group. Finally, from the collection of publications, research was expanded using backward and forward reference and author searching, also known as chain searching.

Research studies collected were ideally published within the last ten years. That said, literature from as early as 1999 was used to paint the context of the present study. Literature was focused within but not limited to the Canadian context. Literature from the international context was used to broaden understanding of the history of this field of study relevant to the present study. For instance, publications from the United States were included often because of the proximity and similarity to the Canadian context. Moreover, international studies were included to gain understanding of the concepts discussed in the present study as they may be understood by international students in Canada that might be sampled in the present study. The literature collected was entirely in English, which means that relevant articles in other languages were probably overlooked. The literature review search was performed from August 2021 to September 2022.

Post-secondary Student Mental Health and Resilience

Throughout 2015 and 2016, the Association for University and College Counselling Center Directors surveyed 529 directors of post-secondary institutions (Reetz et al., 2016). They found that anxiety, depression, and relationship concerns were the most predominant and increasing concern among college students they met with - 50.6%, 41.2%, and 34.4% respectively (Reetz et al., 2016). In 2020, over 60% of students felt "more than average" or "tremendous stress" (Mental Health Commission of Canada, 2020) and over 40% of students reported that stress has affected their academic performance. The results of the National College Health Assessment II Canadian Reference data showed that from 2013 to 2019, there was a significant incline in self-reported stress, psychological distress, and diagnosed mental illness in students – particularly female-identifying students (Linden et al., 2021). Protecting and promoting student well-being and resilience is even more important now in the wake of the COVID-19 pandemic. Interview surveys with American college students revealed that 71% experienced increased stress and anxiety due to the COVID-19 pandemic (Son et al., 2020). Post-secondary students have been facing a "crisis point" in anxiety and stress that hinder mental health (Fried et al., 2020). The negative impacts of the COVID-19 pandemic on higher education reinforces the urgency for prevention and interventions addressing the mental health of this already vulnerable population (Mental Health Commission of Canada, 2020; Son et al., 2020).

Mental health issues are impacting student retention and performance. Between 2012 and 2017, Canadian post-secondary institutions saw a tripling in dropout rates in Canadian students due to mental health problems (Marsh, 2017). Students across the entire performance spectrum can experience mental turmoil from depleted resilience (Cuevas et al., 2017). Moreover, it is not just domestic post-secondary students who are suffering from a lack of access to mental health resources. Students studying abroad from North American and international students studying in North America have been shown to face culturally defined barriers and obstacles to accessing and utilizing mental health services (Ibrahim & O'Connell, 2022). Mental health resources need to find a way

to reach students who are studying outside of their home country, or who are completing their education remotely.

In 2020, the Canadian Standards Association (CSA) Group and the Mental Health Commission of Canada partnered to publish the National Standard for Mental Health and Well-being for Post-secondary Students – the first of its kind even on the international stage. The 'National Standard' is a framework and strategic model for supporting student mental health and calls post-secondary institutions to action, praising existing efforts and inspiring further action (Mental Health Commission of Canada, 2020). The CSA Group, while not a government body able to mandate standards or codes, is a global leader in addressing emerging complex issues and technologies via standards development and testing, inspection, and certification. Many CSA Group standards and codes are cited in legislation at federal, provincial, municipal levels across Canada. Around the same time of the publishing of the 'National Standard' (Canadian Standards Association Group, 2020), the American College Health Association published the Healthy Campus Framework which evaluates an institution across infrastructure, community, and culture for student well-being (Tims et al., 2020). Both frameworks are designed to guide post-secondary institutions toward solutions that better support their students in mental health and well-being. Future actions require elements of online or internet-based services that work together to offer a full spectrum of mental illness alleviation and well-being support (Cornish, 2021). With students being such a particularly at-risk group, there is a responsibility of post-secondary institutions to invest in and offer students innovative solutions which can meet their needs. Improved well-being is a means to organizational effectiveness, health care cost reduction, and human resource sustainability (Abid & Ahmed, 2016). Incorporating well-being supports in the post-secondary environment and practices inspires creativity, innovation, and lifelong learning in society (Canadian Standards Association Group, 2020).

Despite the ever-climbing demand for support, access to effective traditional counselling services is more limited than ever (Copeland et al., 2021; Jaschik, 2020; Mental Health Commission of Canada, 2020; Reetz et al., 2016; Scharmer et al., 2020;

Wathelet et al., 2020; Winerman, 2017) with overwhelming demand and healthcare budget cuts (CAMH.ca, n.d.-b) contributing to longer waitlists, longer wait times, and student dissatisfaction (Cornish, 2021; Cornish et al., 2017). Innovative approaches and methods are required to address the increasing burden of mental health challenges in post-secondary students across Canada and the world.

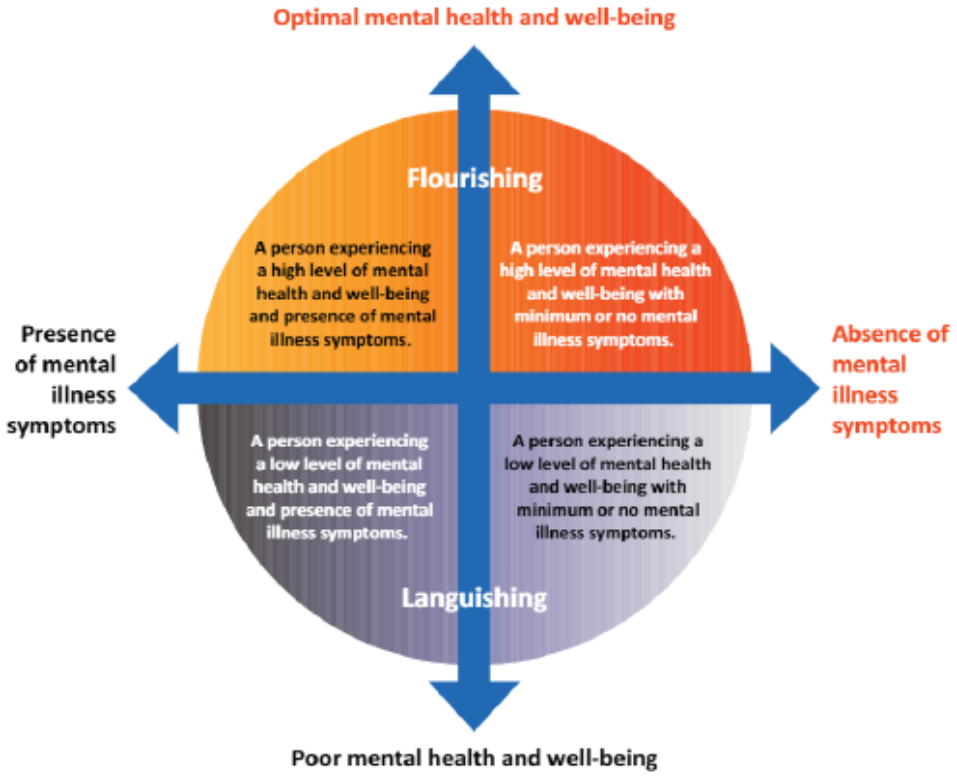
Mental Health

Mental health is a person's changing state or condition regarding their psychological, social, and emotional well-being (Centers for Disease Control and Prevention, 2021; World Health Organization, 2022). While it is recognized that mental health is more than the absence of mental illness, the conventional healthcare system tends to focus efforts for improving mental health almost exclusively on eliminating mental illness (Diener & Seligman, 2004; Huppert & So, 2013; Keyes, 2016; Keyes, 2002, 2007). Only recently has promoting well-being been recognized as a viable option for remediating the mental health crisis (Huppert & So, 2013; Keyes, 2007). Only recently have research, practice, and policy shifted toward salutogenic approaches (Keyes, 2007, 2016; Keyes, 2002) though the idea of studying the "etiology" of health has circulated in social sciences for just under half a century (Mittelmark & Bauer, 2017). Dr. Martin Seligman and his colleagues have tirelessly advocated for and advanced the field of psychology called positive psychology which focuses on human strengths, health, and well-being since Seligman's former presidency for the American Psychological Association in 1998 (Seligman, 2012). Within the scientific field of positive psychology, the question most posed is "what makes life worth living?" rather than "what pathologies need to be eradicated to experience well-being?"

Positive psychology balances the perspectives in shaping and maturing the complete state model, *hale*, for mental health behaviour intervention. *Hale*, i.e., holistic health behaviour intervention is the ideal approach to understanding and improving the human experience (Keyes, 2016). A holistic conceptualization of mental health is that of mental health dual continuum (figure 2).

Figure 2.

Keyes's Mental Health Dual Continuum



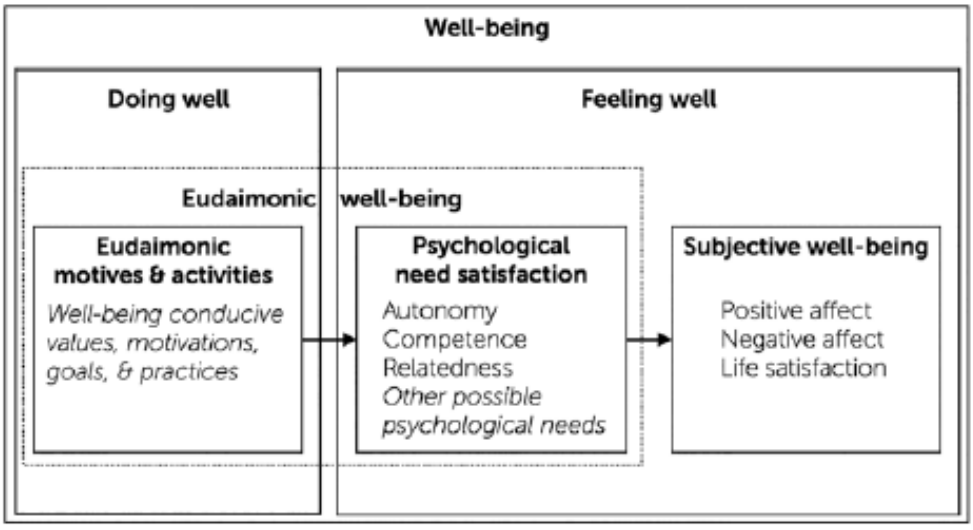
Well-being

Positive psychology began with the study of happiness and its measure, life satisfaction (Seligman, 2012). It was theorized that being happy and satisfied with life came from positive emotion, engagement in life, and meaning in life (Seligman, 2012). Positive psychology has moved away from using happiness as the epitome of a life worth meaning. A primary reason for this is that life satisfaction is highly influenced by mood at the time of evaluation (Seligman, 2012). Well-being has since taken center stage as the primary topic and goal of positive psychology. Well-being is a construct comprised numerous operationalizable elements (Huppert & So, 2013; Seligman, 2012). Seligman maintains that PERMA (Positive emotion, Engagement, positive Relationships, Meaning, and Accomplishment) are the key elements or "building blocks" of well-being (Seligman, 2018). PERMA provides an idea of how to gain insight into someone's level of well-being. After a comprehensive review of influential theories, Martela & Sheldon (2019) proposed a model which further summarizes these elements of well-being into

two categories: doing well and feeling well (figure 3). This model, called the Eudaimonic Activity Model, shows well-being as a combination of psychological needs satisfaction, eudemonic motives and activities, and subjective (also known as hedonic) well-being (Martela & Sheldon, 2019). Eudaimonic motives and activities are complex, conative human activities which contribute to an individual's sense that their life was objectively "well-lived" and often lead to feeling well (Martela & Sheldon, 2019). Common operationalizations of eudaimonic well-being include prosocial impact, self-actualization and acceptance, achieving potential, social significance, having a sense of purpose, and mindful life engagement (Deci & Ryan, 2008; Martela & Sheldon, 2019). The model also serves to highlight the complexity of well-being and the interrelatedness of eudemonia and hedonia in its conception.

Figure 3.

Martela and Sheldon's 2019 Eudaimonic Activity Model



This model is in line with Seligman's elements of well-being, PERMA. Seligman argues, however, that because well-being is an intangible construct, these elements may contribute to well-being, but they do not define well-being (Seligman, 2018; Seligman, 2012). Instead, he posits "flourishing" to be the gold standard measure of the intangible construct of well-being (Seligman, 2012). Hupport and So (2013) claim that flourishing individuals must have all core features (positive emotions,

engagement/interest, and meaning/purpose) plus three of the six additional features (self-esteem, optimism, resilience, vitality, self-determination, and positive relationships). The Flourishing Scale (Diener et al., 2010), which gives a single psychological well-being score, includes items of life satisfaction (a.k.a. mood and happiness), positive social relationships (a.k.a. relatedness), self-acceptance, purpose and meaning, interest and engagement in life, and the need for competence (a.k.a. accomplishment). The Harvard flourishing program' measures six domains: 'happiness and life satisfaction', 'mental and physical health', 'meaning and purpose', 'character and virtue', 'close social relationships', and 'financial and material stability' (Harvard University, n.d.). Flourishing has been defined as "the experience of life going well", synonymous with high levels of mental well-being (Huppert & So, 2013). Flourishing and well-being are so enmeshed within the realm of mental health, that it is difficult to say whether distinguishing the two in semantics is warranted when it comes to designing health behaviour change interventions. For the purposes of the present study, well-being and flourishing are considered synonymous. For consistency, well-being is the chosen language for the present research.

Resilience

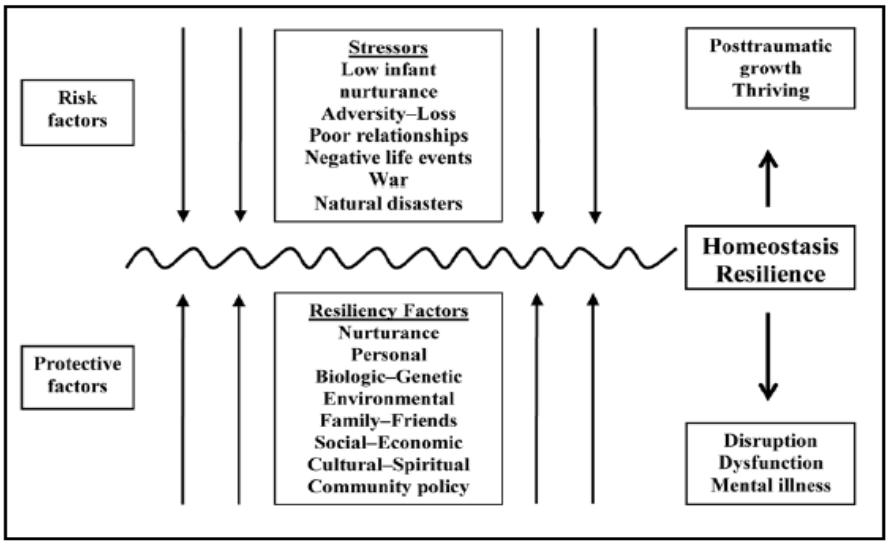
One's well-being and, subsequently, their mental health is prone to vary in response to various kinds of negative stressors and psychopathologies throughout their life – a balancing act. This balancing act is called biopsychospiritual homeostasis. A response to biopsychospiritual homeostatic disruption can typically lead to one of four outcomes: (a) elevation to a new, higher homeostasis, (b) return to baseline homeostasis, (c) establishment of a new, lower homeostasis, or (d) maladaptive/dysfunctional strategies for coping (Connor & Davidson, 2003). The outcome one finds themselves in is highly influenced by a complex relationship with resilience.

In the recent past, resilience was seen as a fixed, trait-based, successful stress-coping ability called "hardiness." Many interventions still measure resilience as a stable personality trait (Chmitorz et al., 2018). Over the past couple decades, the

multidimensional “characteristic” became recognized as variable by context, time, age, gender, and cultural origin (Connor & Davidson, 2003). Today, operationalization of the construct is similar to its trait-based roots, but resilience as a construct is instead viewed as process- or outcome-oriented (Chmitorz et al., 2018; Herrman et al., 2011; Pidgeon et al., 2014). In other words, resilience as a construct is the dynamic process of adaptation and is, in itself, another homeostasis (Chmitorz et al., 2018; Herrman et al., 2011). Operationalization of such a construct often involves assessing availability of resilience factors (e.g., social support, self-efficacy) to maintain or regain mental health despite significant adversities (Connor & Davidson, 2003). More holistic perspectives also connect individual resilience to the resilience of their environment (Herrman et al., 2011; Ungar et al., 2008). Resilience as a construct includes not only an individual’s capacity to navigate resources that sustain well-being, but also factors such as the capacity of that individual’s physical and social ecologies to provide such resources and the effective negotiation between individuals, their families, and their communities for resource sharing (Ungar et al., 2008). Herrman and colleagues (2011) developed a model of resilience influencing factors, pictured below which summarizes such a holistic conceptualization of resilience (depicted below in figure 4).

Figure 4.

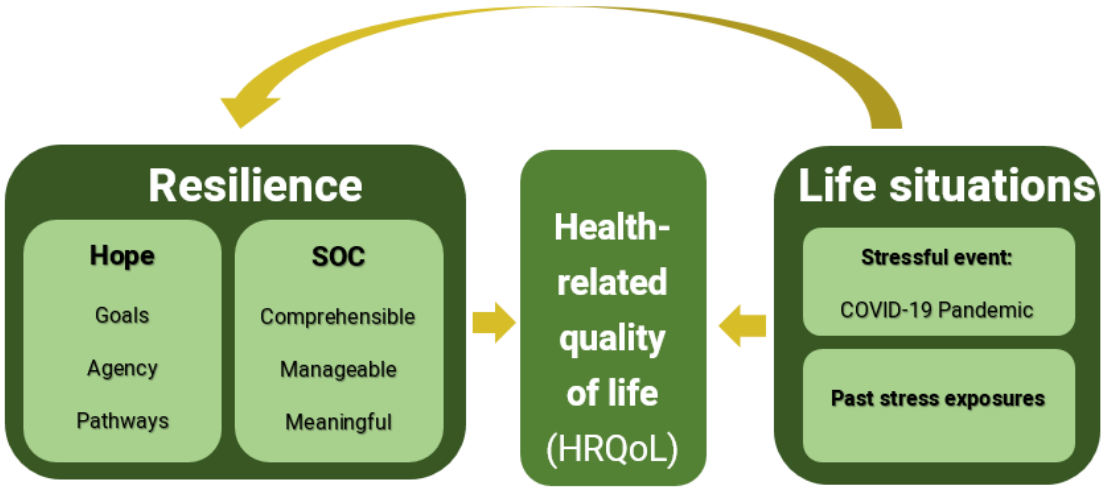
Herrman and Colleagues’ 2011 Factors of Resilience



Some research summarizes resilience factors even further and define them under two categories: one's sense of coherence plus one's hope (Mittelmark & Bauer, 2017; Tal-Saban & Zaguri-Vittenberg, 2022). As an example, a recent study of Israeli adolescents' resilience (Tal-Saban & Zaguri-Vittenberg, 2022) depicts the reciprocal relationships of resilience, health-related quality of life, and life situations in their study model below (figure 5). In this model, hope is a motivational cognitive structure of one's perceived ability to successfully and efficiently recognize and use different means to fulfill personal goals even despite stressors (Tal-Saban & Zaguri-Vittenberg, 2022). Sense of coherence is comprised of one's ability to recognize and understand consequences throughout life (life is comprehensible), to have flexibility in choosing management and coping strategies (life is manageable), and to frame stressors as worthwhile challenges (life is meaningful) (Tal-Saban & Zaguri-Vittenberg, 2022).

Figure 5.

Tal-Saban and Zaguri-Vittenberg's Program Model of Resilience



Note. SOC stands for 'sense of coherence.'

While the way to categorize resilience factors may vary, the key message for health interventions is the same: resilience can be taught, learned, and practiced as a protective skill to maintain or improve mental health.

Where the goal of resilience-training interventions is to increase resilience, it is important to simultaneously distinguish resilience as an outcome. Resilience as a primary outcome is, in its most simplistic form, mental health relative to stressor load (Chmitorz et al., 2018; Herrman et al., 2011). From this stance, stress and resilience can be seen as two sides to the same coin (Fosha et al., 2019). Resilience-building interventions also mean to maintain or restore mental health and well-being. As such, it is important that interventions also collect comprehensive surrogate outcome measures such as mental health-related constructs and stress perceptions (Chmitorz et al., 2018). Measuring outcomes related to the target outcome construct is best practice in evaluating effectiveness of interventions (Glasgow et al., 1999, 2019; Holtrop et al., 2021; RE-AIM.org, n.d.).

Promoting Mental Health, Well-being, and Resilience Through Health Behaviour Interventions

Health behaviour interventions are intended and designed to encourage behaviour which moves an individual toward health and well-being. To move an individual across either continuum of mental health would mean a change in health behaviour. There are three categories of health behaviour: (1) preventative health behaviour – preventing or detecting illness while subjectively healthy and asymptomatic; (2) illness behaviour – defining health and establishing a remedy while subjectively ill; and (3) sick-role behaviour – getting well while subjectively ill (Glanz et al., 2015). A health behaviour intervention can, in other words, mean targeting mental illness tolerance and mitigation only and/or targeting well-being development and reinforcement. (Canadian Standards Association Group, 2020).

Health behaviour intervention often begins with behaviour change theory. Behaviour-change theory spans from the individual level to the interpersonal level, to the community and group level. The Health Belief Model (Hochbaum et al., 1952), the Theory of Planned Behaviour (Ajzen, 1991), the Theory of Reasoned Action (Fishbein & Ajzen, 1975), and the Transtheoretical Model of Change (Prochaska & DiClemente, 1984) are popular examples of individual-level health behaviour theories. After a

comprehensive review of behaviour change theories, Michie and colleagues (2011) summarized how they translate into sources of behaviour that can be targeted by health behaviour change interventions: capability, motivation, and opportunity (figure 7). Individual level behaviour change theory significantly influence an intervention's process and effect theories, that is, its planned inputs, outputs, and outcomes (Glanz et al., 2015). Ideally, health behaviour interventions would orient around influencing behaviour with recovery principles in mind rather than a deficit model (Cornish, 2021). Principles of recovery orientation are: self-direction, person-centered, empowerment, holistic, non-linear, strengths-based, peer support, respect, responsibility, and hope (American Psychological Association, 2012). These recovery principles align strongly with interventions which are geared toward promoting well-being and resilience. Clear parallels can be drawn between how well-being is measured and the recovery principles. For instance, positive psychology and well-being are innately strengths-based and hopeful (Cornish, 2021; Seligman, 2018; Seligman, 2012). Recovery-oriented programs which focus on people's entire lives including mind, body, and sense of community intertwine with one's resilience and sense of life satisfaction, and relatedness.

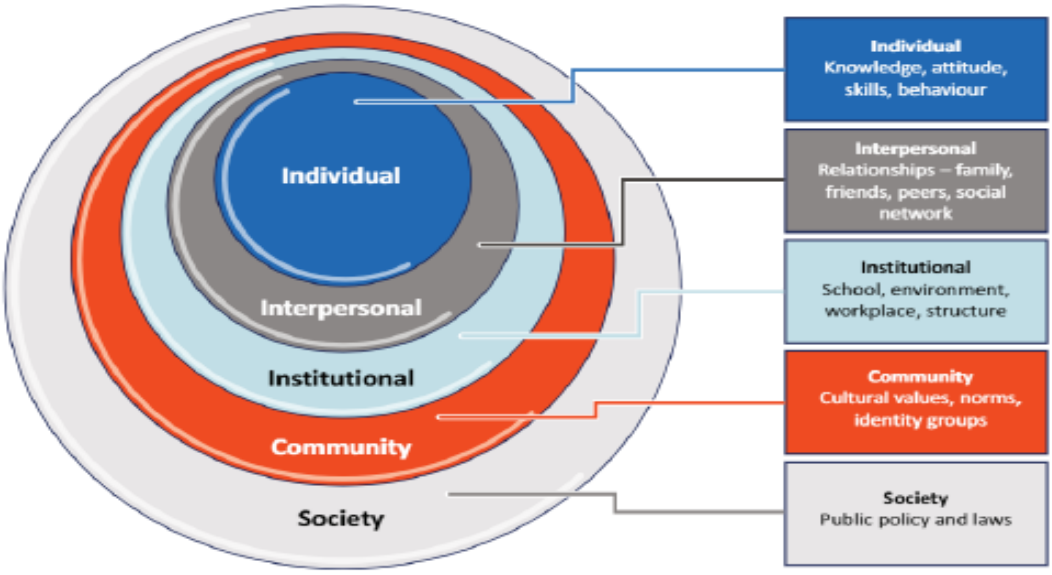
Implementation of Health Behaviour Interventions on Post-Secondary Campuses

Health behaviour overall refers to "the actions of individuals, groups, and organizations as well as those actions' determinants, correlates, and consequences, including social change, policy development and implementation, improved coping skills, and enhanced quality of life." (Glanz et al., 2015, p.10). The breadth of Glanz and colleague's definition is deliberate; human behaviour is complex and dynamic and cannot be resolved by focusing solely on the individual level, and hence, cannot be deciphered by a single discipline. Interventions aimed at changing health behaviour require inter- and transdisciplinary focus (Glanz et al., 2015; Issel & Wells, 2017). A balance of perspectives and expertise across individual, interpersonal, and community and group health behaviour is the closest intervention planners can come to designing and implementing a high quality intervention (Glanz et al., 2015; Issel & Wells, 2017).

The Canadian Standards Association (CSA) Group acknowledged the necessity of an interdisciplinary approach to post-secondary student mental health intervention by presenting Bronfenbrenner's Socio-ecological model of dynamic personal and environmental interrelations (figure 6) in their 'National Standard' for Post-Secondary Mental Health (Canadian Standards Association Group, 2020).

Figure 6

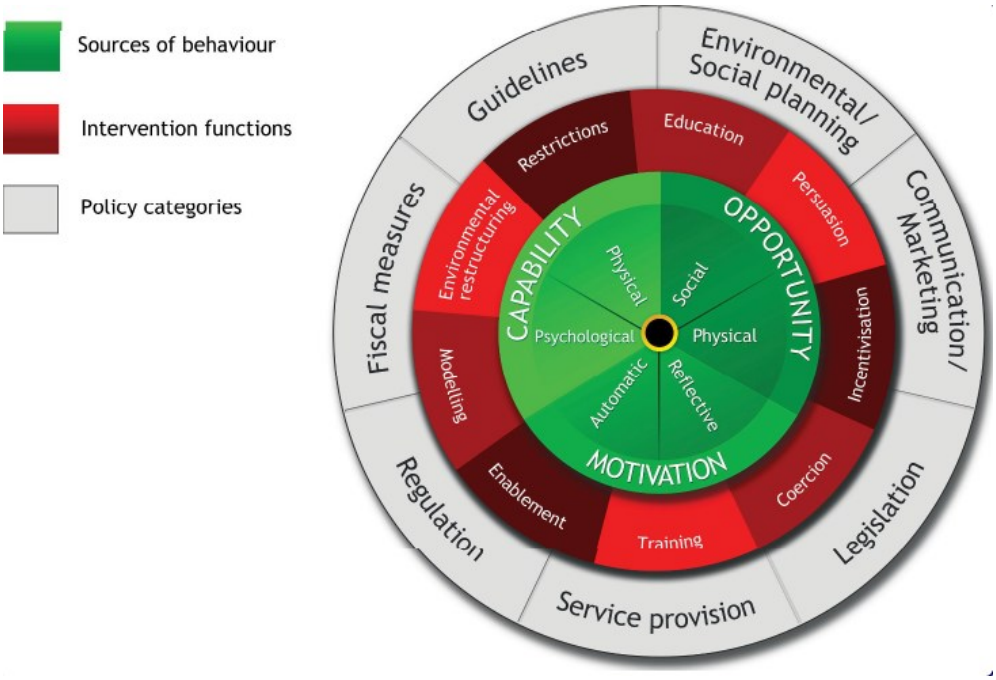
Bronfenbrenner's Socio-ecological Model



A socio-ecological model is useful for dissecting influences on behaviour and levels of intervention on health behaviour, but by itself does not directly translate to practice for health behaviour interventions. Michie and colleagues (2011) addressed this issue by creating a health behaviour intervention model with the ability to account for the multi-directional influences of individual and environmental characteristics *plus* sources of behaviour and mechanisms of behaviour change. The idea behind this model – the Behaviour Change Wheel – is that the intervention functions are all aimed at addressing deficits in sources of behaviour (Michie et al., 2011). Figure 7 depicts the Behaviour Change Wheel of health behaviour change (Michie et al., 2011).

Figure 7

Michie and Colleagues' 2011 Behaviour Change Wheel



This model may be more pertinent to post-secondary institutions working to seek out and provide resources for their students. Not only can post-secondary institutions use this model to understand what sorts of interventions they are already implementing and providing to their students, but also recognize gaps in the sorts of interventions offered. Moreover, this model underscores the need for post-secondary institutions to simultaneously address student mental health from the "top down", i.e., put various types of policies in place to support student mental health and promote access to mental health interventions and uptake of the 'National Standard' (Canadian Standards Association Group, 2020).

In implementation science, there is a framework for guiding the improvement of adoption and sustainability of evidence-based interventions for program planners, evaluators, and the like (Glasgow et al., 2019; RE-AIM.org, n.d.). RE-AIM is a part of the integrated RE-AIM and PRISM framework from implementation science. RE-AIM stands for reach, effectiveness, adoption, implementation, and maintenance. The framework outline can be found in Appendix B. While not a part of the 'National Standard'

(Canadian Standards Association Group, 2020) explicitly, the 'National Standard' does promote ongoing evaluation for continuous improvement. The primary audience 'The 'National Standard'' aims to hold accountable to evaluation is post-secondary institutions. For these institutions to make informed decisions in selecting mental health resources for their students and upholding the 'National Standard', it is important that services such as Q-Life draw clear parallels to the 'National Standard' and abide by gold-standard models of evaluation.

Mental Health Interventions for Post-secondary Students

The models and theories around mental health, well-being, and resilience all pull together in designing mental health interventions meant to remedy the post-secondary student mental health crisis. There is an abundance of examples of mental health interventions successfully implemented on campus and actively supporting students in their overall mental health.

A cognitive behavioural therapy-based program delivered to graduate health professional students by nurse practitioner students showed that after seven weekly workshops, students improved their abilities to recognize stressful events that trigger negative thoughts and result in depression, anxiety, and/or unhealthy behaviours and subsequently, to regulate their emotions, cope with stressors in positive ways, and problem solve (Melnyk et al., 2022). In short, students felt better equipped to thrive and, in turn, experienced better mental health when given proper tools (Melnyk et al., 2022). Importantly, the intervention group had greater improvements than the control group who received only three educational modules. Practice-based preventative programs such as this are imperative for promoting well-being and preventing escalated mental health problems (Melnyk et al., 2022).

Clinical trials of a resilience program with American college students showed that following a four-session program focused on resilience, students experienced improved emotion regulation, mindfulness, and cognitive behavioural therapy skills (Akeman et

al., 2020). The cognitive behavioural therapy skills mediated clinical improvements in depression symptoms and perceived stress (Akeman et al., 2020).

The evidence shows that practice-based preventative programs which foster resilience are effective in the student population. There are many similar, clinically efficacious interventions resourced for improving student well-being; so, why are students still struggling at such an alarming rate and why is the system so overwhelmed? The answer lies in part with the distribution of these resources and the triaging of those accessing care (Cornish, 2021). Counselling is effective for addressing these issues, and 72% of students agreed that counselling services helped with their academic performance (Reetz et al., 2016). There remains to be the issue of significant wait times and unmet needs for individuals who are ready to seek support (Mental Health Commission of Canada, 2017; Reetz et al., 2016).

Stepped Care 2.0

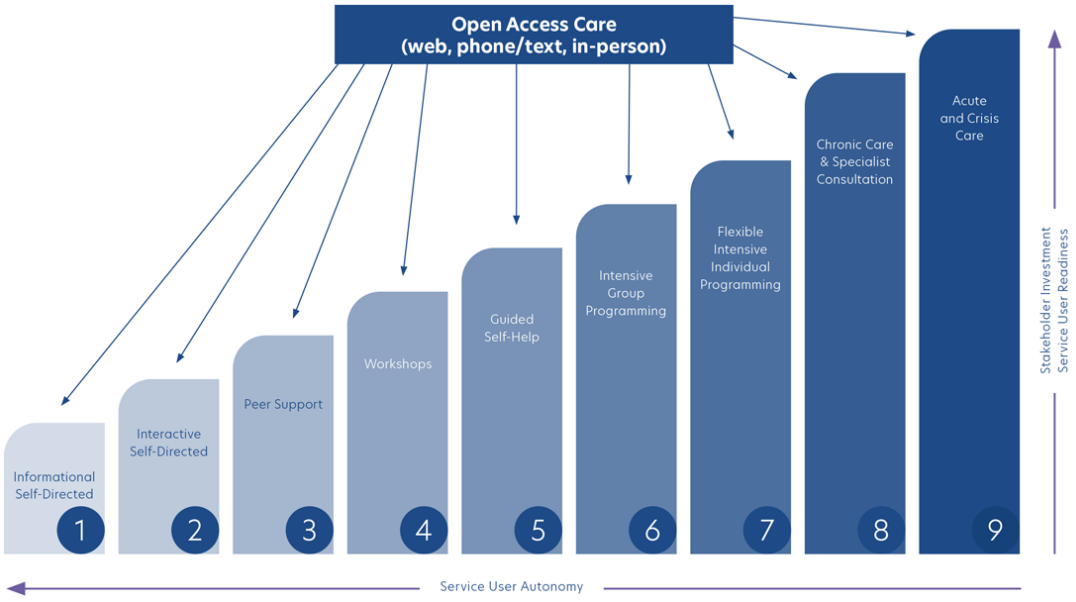
Even the *perfect* mental health resource or service is ultimately ineffective at improving community and societal resilience and well-being when offered in isolation. Where individual resilience is highly impacted by community resilience (Ungar et al., 2008), it stands to follow that the ability to distribute effective options is crucial to meeting individuals where they are and is an equally necessary part of effective mental healthcare.

Stepped Care 2.0 (SC2.0) is a revolutionary system for "rationally distributing limited mental health resources to maximize the effectiveness of service for all students" (Cornish et al., 2017, p.13). The model captures the full continuum of care and is generally organized around nine steps that range from informational and self-directed approaches, up to more intensive interventions that conclude at the highest level with acute in person services and crisis care (figure 8). SC2.0 outlines person-centered mental healthcare that leverages a combination of online and in-person services to effectively increase service capacity while maintaining high student satisfaction (Cornish, 2021). A central tenet of SC2.0 is to support individual agency and assist individuals in self-

identifying their preferred care modality before connecting them the least resource intensive form of that care from the first point of access, be it campus-based activities or clinic-based activities. A critical characteristic of SC2.0 is that that it advocates for open access care (via web, phone/text, or in-person) at each of the nine steps.

Figure 8

Stepped Care 2.0 Model



In the most recent model of SC2.0, step one is 'Informational Self-directed Care'. At this step there is the lowest cost of intervention and commitment for the student and the provider. Moreover, there is highest level of student empowerment balanced with the highest level of required autonomy and self-advocacy. Step 2 of SC2.0 is 'Interactive Self-directed Care'. At this step, individuals require less autonomy and more commitment. At steps one and two, the student can engage at their own pace and, if more intensive care is needed, can turn waiting time into a productive period of building knowledge. Bridge the Gapp (bridgethegapp.ca, n.d.) is a free web-based mental health resource that connects users to educational resources and courses, mood self-reports, and local service directories; it is an example of a step one and step two resource in

SC2.0. Step three of SC2.0 is 'Peer Support'. The step is beneficial to those seeking a community and opportunity to share coping strategies.

Kids Help Phone Peer-to-Peer Community (peertopeer.kidshelpphone.ca, n.d.) – an example of step three - is where young folks can publicly post thoughts and experiences around mental health and illness. Togetherall (togetherall.com/en-ca, n.d.) and 7 Cups of Tea (7cups.com, n.d.) are examples of services which overlap step two and step three. Togetherall is a Canada-wide, secure, online platform aimed at reducing stigma and judgement around mental illness. On Togetherall, individuals can anonymously post thoughts, feelings, and experiences with mental health and illness. Togetherall also offers a selection of self-administered, asynchronous self-help courses and resources in managing grief, loss, mental illness, anger, alcoholism, problematic eating, and sleeplessness. Togetherall allows users to assess and track their feelings and experiences via journaling and goal setting and self-assessments in social phobia, sleeping, emotions, and eating concerns. 7 Cups of Tea offers self-help guides, free 24/7 chat with volunteer listeners, and affordable online therapy.

Step four of SC2.0 is 'Workshops' and an example of services at this level include Well Central (WellCentral.ca, n.d.) and CAMH (CAMH.ca, n.d.-a). Well Central is an online, self-administered "virtual recovery college" developed by the Canadian Mental Health Association with courses in addiction recovery, self-compassion, overcoming loneliness and isolation, and in wellbeing. CAMH is a centralized point of contact for a range of clinical care services for patients and families of all ages. CAMH is particularly focused on serving the population in need of mental illness and addictions services.

Step five of SC2.0 is 'Guided Self-help' and an example is Welltrack Boost (WellTrack-boost.com, n.d.) where users can access self-guided, clinically supported, cognitive behavioural therapy-based tools in a web application.

Step six of SC2.0 is 'Intensive Group Programming' and an example is MindWell (MindWellU.com, n.d.). MindWell is a workplace intervention where participants across the whole company engage in training sessions to build resilience.

Step seven of SC2.0 is ‘Flexible Intensive Individual Programming’, and examples are Therapy Assistance Online (taoconnect.org, n.d.) where participants are matched with online counselors for online counseling and Good2Talk (Good2Talk.ca, n.d.) is where participants can text or call a 24/7 support phone line.

Step eight of SC2.0 is ‘Chronic Care and Specialist Consultation’ and an example of a service at this level is Mental Health First Aid Canada from the Mental Health Commission of Canada (MHCC) (MHFA.ca, n.d.) and traditional mental health services such as counselling, social work, and psychiatry.

The final step of SC2.0 is ‘Acute and Crisis Care’; it involves the highest level of cost and commitment and minimizes individual autonomy. Given the resource-intensive nature of these services, they are usually offered in smaller, specific geographical regions. Examples of services at this level include crisis text lines, help support phone lines, hospitalization, and extremely specialized care.

Figure 8 above outlines SC2.0 in its traditional linear format, but SC2.0 can be tailored to the context of where it is implemented. Some post-secondary institutions reorganize this model to better fit their values and their local services. For instance, Algonquin College in Ontario, Canada, re-illustrated the model (figure 9) as a cycle to emphasize that all forms of care are equally important and are person-centred (Algonquin College, n.d.).

Figure 9

Algonquin College Model of Stepped Care 2.0

Where implemented, SC2.0 has improved the energy and morale of most post-secondary mental health care providers by cutting back on caseloads and increasing student attendance (Cornish et al., 2017). For students, this translated to significant increases in total time spent with the counselor and the extent to which counseling helped to deal with concerns following the launch of SC2.0 (Cornish, 2021; Cornish et al., 2017). While not statistically significant, it should be noted that wait times, time spent in waiting rooms, and the extent to which students felt understood by their counselors also improved post launch of SC2.0, further supporting the potential for the system at optimizing provision and quality of care (Cornish, 2021; Cornish et al., 2017).

With the SC2.0 model in mind, there is the need to fill each level of care with quality resources and supports that work in concert with one another. As per the National Standard for Mental Health and Well-being for Post-secondary Students (Canadian Standards Association Group, 2020), there are guiding principles and models for institutions looking to act. These principles are student-centered; equity, diversity, and inclusion; knowledge-informed; health promoting and harm reducing; thriving community and culture of well-being; and continuous improvement (Canadian

Standards Association Group, 2020). Many existing and traditional services might have met these principles but have been rendered moot or forced to take on complicated adaptations in the new COVID-19 pandemic world and its safety protocols. In 2016, 90% of clinical services did not provide telepsychology clinical services and 72% did not provide after-hours call service (Reetz et al., 2016). Telehealth services take time to develop, implement, and evaluate. In the COVID-19 pandemic, a lack of remote services can cripple mental well-being interventions and failure to adapt quickly can be catastrophic for students' well-being (Mental Health Commission of Canada, 2021a). The new reality we find ourselves in necessitates mental health interventions that maintain effectiveness throughout distancing, isolation, and lockdown protocols for a pandemic. In other words, it necessitates formally vetting and incorporating the developed the telehealth services that are exemplified across SC2.0. As a primary occupational and social connection and authority figure for students, academic institutions have an obligation to prioritize allocation of resources for ensuring students' access to mental health services and intentionally reach out to students with special circumstances (Liu et al., 2022). Leveraging emerging telehealth and internet-based services within the SC2.0 model is part of fulfilling that responsibility (Liu et al., 2022). The COVID-19 pandemic highlighted areas for improvement in the mental healthcare system, but it also inspired the development and elevation of many online-based resources and platforms that allow for greater reach, accessibility, and inclusion in care. Development of these services reduce the burden on the traditional, resource-intensive system and allow post-secondary institutions to support their students.

Online-based Resources and Services

Digital mental health solutions can be considered controversial in today's day-in age where many students are experiencing problematic internet use and subsequently compromised mental health. In a sample of Canadian university students, undergraduates and Apple users were found to be a particularly vulnerable groups for risky smartphone addiction (Rudkovska et al., 2022). The pandemic has made instances of harmful social media consumption on smartphones salient (Jiménez et al., 2022). A

German meta-analysis found only a small negative correlation between social media use and mental health, but emphasized that the relationship is a complicated one that depends on the exact indicators used (Meier & Reinecke, 2021). In a physically distanced world, virtual social time has been a preferred and more emphasized way to manage stress (Faulkner et al., 2020). The impacts of social media and internet usage on mental health are certainly important to be aware of while considering internet-based mental health resources. Still, technological interventions for mental health and resilience can be effective and should be conscientiously explored.

Despite the potential challenges and drawbacks of online delivery methods, there are opportunities and advantages that substantiate the use of such services in mental healthcare. Students are interested in using e-mental health services because they are curious or concerned about their symptoms, willing to acquire psychological skills and competencies online, wanting to monitor their psychological status, and needing access to care (Montagni et al., 2020). Where students find services that prove to be trustworthy, comprehendible, and secure, e-mental health solutions prove to be an asset in students' arsenal of support (Lal, 2019; Montagni et al., 2020; Strudwick et al., 2020). Students appreciate that e-mental health services are convenient, confidential, and available on demand across the continuum of care (Lal, 2019; Montagni et al., 2020). In March 2020, the Mental Health Commission found that youth ages 14 – 18 (the next generation of post-secondary students) turned to online resources 53% of the time when seeking help as compared to family (25%), friends (4%), or school (3%) (Mental Health Commission of Canada, 2022c).

Online services will likely never replace traditional, in-person mental health services. An American study found that while traditional, in-person and phone support was more effective than online support for students experiencing suicide ideation, online help-seeking helped students to overcome barriers to traditional help-seeking (De Luca et al., 2020). For more severe cases of mental health issues online services may serve better as a supplement to traditional services. For less severe cases, online services have proven to be efficacious in supporting student mental health. An online

synchronous video counseling session was found to be as effective as in-person traditional counseling services for students with mild to moderate anxiety (Novella et al., 2022). In an American cognitive-behavioural skill-building intervention, freshman college students with elevated baseline anxiety had significant decreases in symptoms and attained a higher grade point average than those who did not participate in the program (Melnyk et al., 2015). In a related study of the same program, findings indicated $14,262 dollars were saved for every prevented instance of hospitalization with the cognitive behavioural therapy-based program (Melnyk, 2020). Another cognitive-behavioural skills building program was administered virtually with graduate students (Melnyk et al., 2022). Participants of this program reported less depression and anxiety and healthier lifestyle behaviours than the control group (Melnyk et al., 2022).

Online mental health services have shown to help students to mitigate and manage their symptoms directly. Moreover, they have shown to empower students to support their peers in mental health. An online suicide prevention program was associated with significant improvements in students' gatekeeper attitudes including preparedness to help psychologically distressed peers, likelihood of intervening, and self-efficacy to help effectively (Smith-Millman et al., 2022). Overall, students were more likely to ask about suicide and refer peers to counseling (Smith-Millman et al., 2022). The literature foreshadows great returns on investment of quality online mental health interventions and associated technologies.

In October of 2021, the Mental Health Commission of Canada (MHCC) formally recognized the demand for and potential of online mental health interventions and associated technologies by publishing a toolkit for e-mental health implementation (Mental Health Commission of Canada, 2021c). In this toolkit, MHCC identified a gap in present artificial intelligence (i.e., user-responsive and adaptive) mental health technologies: research and development domains are pathos-centric and focused on diagnosis as opposed to prevention of languishing and preservation of well-being and resilience (Mental Health Commission of Canada, 2021b, 2021c; Orji & Moffatt, 2018). This is a critical gap considering that the definition of mental health includes well-being.

Alslaity et al. (2022) and Orji and Moffatt (2018) found another emerging trend in the electronic and telehealth options being developed to meet need and assist with management strategies. Current technologies meant to support primary and secondary healthcare are still mostly static and inadequate in sustaining health behaviours (Alslaity et al., 2022; Mental Health Commission of Canada, 2021c; Orji & Moffatt, 2018). Persuasive strategies for changing mental health behaviour and attitudes are commonly employed in electronic applications (Alqahtani et al., 2019). In particular, self-monitoring, personalization, and reminders are popular and generally effective persuasive techniques (Alqahtani et al., 2019); however, the market still has progress to make in catering to users changing wants and needs from e-mental health resources and in operationalizing the optimal amount of behaviour change strategies used (Alslaity et al., 2022).

Another shortcoming of online mental health services so far is that they are predominantly synchronous. Synchronous services involve live, real-time interaction between a service provider and a user/student. Online synchronous services address barriers of accessibility and resources related to traditional services but have other restrictions related to limited resource in scalability. An area less explored is the efficacy of evidence-based and evidence informed mental health services that are online, asynchronous (i.e., without a live component), and self-administered. The researcher found three such studies investigating the efficacy of such programs, but two are in their early stages of planning. One planned study is outside of North America. The Spanish randomized control trial planned to compare university students' changes in resilience, coping skills, psychological well-being, and depression and anxiety levels across groups who participate in a self-administered online resilience program versus a self-administered online healthy lifestyles program versus a waiting list control (Palma-Gómez et al., 2020). The other planned study is a randomized control trial focused on improving perceived stress and diet quality in Canadian first-year students by implementing the Social Cognitive Theory to build resilience and self-efficacy through development of self-care habits and mindfulness (Trottier et al., 2021). The third study

found was completed early 2022 in Canada (King et al., 2022). The online mental health literacy course implemented pedagogical principles and was tailored to undergraduate students. Compared to a control group, participants of the program had strong uptake; showed improvement in mental health knowledge, emotional self-awareness, drug use, and sleep; and gave positive reviews of the program's engagement, relevance, and applicability (King et al., 2022).

While there have been promising programs, there remains a gap in North American literature around high quality, scalable, whole health-focused online mental health services that demands attention and investigation. The lack of focus on well-being, the sub-optimization and rigidity of behaviour change strategies, and the lack of scalability in current market options mean that the 'National Standard' is not being met.

The Q-Life Program

The market offers many technologies and mobile apps that can help improve access to care for students needing mental health services. One such program is called the Q-Life program for post-secondary students. Q-Life is an online modular, self-directed training program which aligns with the dual health continuum, positive psychology's conceptualization of well-being, and prominent theories on resilience. Q-Life utilizes evidence-based behaviour change techniques in the form of education, training, incentivization, modeling, and enablement to target elements of well-being and resilience. In Q-Life, students are responsible for their own self-care journey as they learn from fellow understanding students and welcoming experts how to address aspects of their lives such as exploring their identity, developing physical health, fostering healthy relationships, accessing campus resources, and managing finances. As such, Q-life addresses recovery principles such as responsibility, holistic, peer support, respect, and hope. Moreover, Q-Life is designed to fulfill steps one and two of SC2.0 and integrate with existing resources of the care model (Cornish, 2021).

Summary of the Literature

The National Standard for Mental Health and Well-being for Post-secondary Students (the 'National Standard') was designed to guide industry and research in the development of mental health solutions and as such, is important to reference against in program evaluation of interventions designed to address mental health and well-being of post-secondary students. To meet the 'National Standard', we need accessible, effective, scalable, and flexible solutions that improve awareness, promotion, prevention, intervention, accommodation, and training around well-being and resilience as major components of mental health. These solutions need to be evidence-informed and practical to protect and promote the mental health of students, champion the 'National Standard', and drive uptake of the 'National Standard' by institutions and their students. The literature shows that addressing the mental health crisis in post-secondary students requires access to effective, online mental health resources and services that take a holistic approach to mental health. Holistic approaches address well-being and resilience instead of exclusively focusing on mental illness and diagnosis of psychopathology. Q-Life is designed to be such a solution. As such, rigorous and continuous evaluation of the Q-life program is warranted as it is implemented. With the 'National Standard' as a reference, the present research will evaluate the effectiveness of Q-Life at improving well-being and resilience over time, program evolution, COVID-19 pandemic impact; will explore elements of Q-Life participation and determine which are most predictive of well-being and resilience; and will investigate the program's reach. This research will help determine where Q-Life stands as a resource aimed at meeting the 'National Standard' and, where appropriate, will make recommendations to guide program development in moving Q-Life toward improving usefulness for post-secondary institutions their efforts to implement the 'National Standard' and supporting student mental health (Canadian Standards Association Group, 2020).

Chapter 3: Methodology

Overview of the Present Research

Many post-secondary students are stressed, anxious, and depressed, and it is taking a toll on their mental health, their well-being, and their academic experiences. Traditional mental health resources are easily overwhelmed and not scalable. For instance, traditional counselling is struggling to manage the influx of students needing and seeking mental health support in the last several years, especially as a result of the COVID-19 pandemic. E-mental health tools are being developed to ease strain on the health care system, but few take an evidence-informed, whole-health approach to well-being and resilience.

This study evaluated the effectiveness of the psychological well-being- and resilience-building Q-Life program, an e-mental health program focused on well-being, lifestyle behaviours, resilience, and Q-Life indicators. The guiding research questions were:

1. Is Q-Life effective at helping students with pre to post improvement in well-being and resilience? To assess this,
    a. A paired sample t-tests and non-parametric sign test was run on QES to assess overall effectiveness
    b. A two-way mixed factorial ANOVA was completed to assess effectiveness between versions for QES and QES Common. QES and QES Common results were compared to check for internal consistency.
2. Does level of engagement influence the effectiveness of the Q-Life program and/or does participation in elements of the Q-Life program related to Q-Life outcomes? To assess this,
    a. A Spearman rank-order correlational test between the engagement element of percent program completion and difference between T1 and T2 QES

b. A two-way mixed factorial ANOVA of QES by percent product completion and time was used to determine if Q-Life's effectiveness was influenced by engagement
c. A hierarchical multiple regression was used to determine the degree to which three models were predictive of T2 QES.

3. Are there differences in effectiveness across program version or COVID-19 subgroups and were there any differences in demographic reach across program versions? To assess this,
    a. A two-way mixed factorial ANOVA on QES by time and program version was revisited and a two-way mixed factorial ANOVA on QES by time and COVID-19 impact was run.
    b. A Kruskal-Wallis H test was run to check for difference between groups and investigate differences in program reach.
    c. Four separate MANOVAs were completed for Q-Life V1 and V3, by gender and then by race to evaluate differences in reach.

Research Approach, Funding, and Ethics

The primary purpose of this project was to evaluate the online well-being and resilience program for post-secondary students called Q-Life to make data-driven recommendations for program development. Program development is aimed at justifying or appraising the need to introduce, continue, terminate, or modify the existing program and its components and aid the accreditation and/or implementation of the 'National Standard' for e-mental health programming for post-secondary students (Canadian Standards Association Group, 2020). While these purposes have general application to the research literature, this work is action research. Action research is a philosophy and methodology of research which models the simultaneous process of taking action and doing research, and critical reflection linking both together to inspire transformative change (Klein, 2021; Reason & Bradbury, 2008). Action research is a form of investigation designed for use by the primary users of a tool, resource, or program, to solve problems and improve professional practices in the

implementation and use of that tool, resource, or program. Action research involves systematic observations and data collection while changes and improvements are being made, which can be then used by the practitioner-researcher in reflection and decision-making. Action research does not have typical control variables or standard intervention timelines because it is less focused on generalizability (Klein, 2021). Action research is a systematically iterative process that helps researchers and users understand the scientific and theoretical constructs underpinning a certain tool, resource, or program, while concurrently evaluating the effectiveness of its use or implementation. By its nature, action research is dynamic and changing. The impetus for this project came from industry to evaluate the program and its evaluation - and the primary intent - was to produce information for the use and implementation by Jackhabbit Inc., the creators and owners of the Q-Life program, and the post-secondary institutions where data was collected. Funding for this research was provided from grants that leverage industry engagement in research, and therefore, the research process was engaged through collaborations between Jackhabbit Inc. and the partner institutions that participated in the development, implementation, and pilot testing of the Q-life program in post-secondary contexts. The present study is considered program evaluation and used previously collected, anonymized data from studies which received ethics approval from Dalhousie and Acadia University ethics boards. As per the Tri-Council Policy Statement Article 2.5 (Government of Canada, 2019) the present program evaluation was exempt from formal board review by Dalhousie University's Research Ethics Board and Acadia University Research Ethics Board. Funding for this project was provided by contracts between Jackhabbit and Dalhousie University in its initial release. Two unrestricted grants from the RBC foundation funded further development of the Q-life product and implementation at Acadia University (the second version of the Q-Life program). Mitacs grants funded student internships that supported the current thesis work, including the researcher's work for this project directly. The researcher was afforded a graduate student grant by The CSA Group which also contributed funding for the present funding. Jackhabbit also received external NSERC-IRAP and ACOA grants to support on-going

programming and development of the Q-life, and the Jackhabbit Platform. Jackhabbit Inc. and its agents had some contribution to the development and refinement of the program and assessment and assisted with the data collection, as they were the industry partner that this research was with. Although Jackhabbit and its agents had some contributions as outlined, they were not involved in the analysis or interpretation of any data or results presented in this thesis.

The Q-Life Program

All data were collected while the Q-Life program was offered via the content delivery platform, Kajabi (Kajabi.com, n.d.). For optimal learning, the recommended timeline for participants was to complete the Q-Life assessment of resilience and well-being at baseline (T1 assessment), then engage in one program module per day and then complete a T2 Q-Life assessment within one month. One module generally included watching a video lesson, logging of daily lifestyle behaviours and mentalities, journaling thoughts and feelings, reflecting on mood before and after journaling, reading pages from the Q-Life companion (a workbook document), and engaging in a related skill-building activity from the Q-Life companion.

The Q-Life experience helps to build skills that protect against the daily challenges of post-secondary life. The Q-life engages students through a series of modules within the Q-Life, called “plugs”. A student’s resilience is meant to be strengthened by daily practices when they “plug into” different healthy lifestyle behaviours and develop skills in different “plugs” of Self-Awareness, Self-Reflection, Foundational Skills, Personal Power, and Resources. The Q-Life was implemented on the Kajabi.com content delivery platform as an experience that targets multiple lifestyle behaviours at once. The reason for this holistic approach is due to the understanding that single skill development in isolation is often ineffective (Steeves et al., 2021). By integrating and impacting multiple lifestyle factors within one program, participants learn to live a healthier life effectively and holistically (Steeves et al., 2021). This is because lifestyle skills are often complementary and inter-dependent. The Q-life module content was identified in Figure 1.

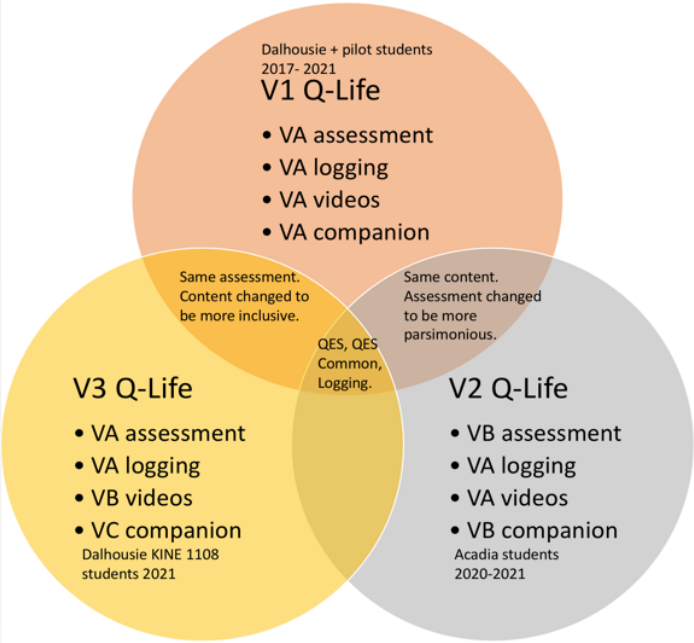
While the recommended timeline was one module per day, students could log in to the Q-Life program whenever they chose to access the journal, log, and/or companion. Video content was 'dripped out' such that one could only access the link to the next video after a day of the last video's link being shared. Students did not need to watch or engage in the videos for the next link to be shared. The assessment could be accessed whenever a Jackhabbit Inc. operator manually reset the assessment. This means that while a student could not access the assessment whenever they pleased, they could take the assessment anytime that a Jackhabbit Inc. operator reset it rather than only at a specific time such as immediately after completing the entire Q-Life program.

Q-Life Version

There were three versions of the Q-Life program over the span of this program evaluation study, each an evolution of the one before it. The overall Q-Life 'Version' is comprised of the Q-Life assessment, the Q-Life logging, the Q-Life video content, and the Q-life companion workbook, each of which are broken down in following sections. Figure 10 outlines the overview of the three Q-Life versions that were evaluated in this study.

Figure 10

Overview of Q-Life Version Comparisons



Q-Life Version 1 (V1) is defined as the program iteration that was available to all Dalhousie University students to enroll in from October 2017 to September 2021. Q-Life V1 is comprised of the Version A (VA) assessment, VA logging questions, VA video lessons, and VA of the companion workbook. V1 had incentivization for students – those who participated were offered approximately 1-3% bonus points in their academic courses.

Expert consultation and reviews of the literature led to revisions of several Q-Life elements which led to the next version of Q-Life, Version 2 (V2). Q-Life V2 is defined as the program iteration that was available to all Acadia University students to enroll in from February 2020 to March 2021. V2 is comprised of Version B (VB) assessment, VA logging questions, VA video lessons, and VB of the companion workbook. The VB companion included new skill-building activities meant to align closer with the video content and replace less relevant exercises. The Q-Life course content was unchanged and covered the same topics presented by the same Q-Life instructors. V2 had incentivization for students – those who participated were offered 1% bonus point in

their academic course for completing both assessments, and 3% bonus points in their academic course for completing the assessments plus ≥80% of the program content.

Further expert consultation and reviews of the literature led to revisions of several Q-Life elements which led to the next version of Q-Life, Version 3 (V3). Q-Life V3 is defined as the program iteration that was available for Dalhousie University students of a first-year undergraduate kinesiology course to enroll in from September 2021 to October 2021. V3 is comprised of VA assessment, VA logging questions, VB videos, and Version C (VC) of the companion workbook. The VB videos covered the same types of content as VA videos but were presented by new Q-Life instructors who represented a visibly different and broader demographic range. Language within videos was also varied slightly to keep up to date on therapeutic practices and inclusive language. The VC companion was also modified slightly to use more inclusive language. V3 had incentivization for students in that the Q-life program was integrated into the first-year kinesiology course – those who participated in both assessments plus ≥80% of the program content received 10% toward their final grade in the academic course.

The Q-Life Assessment

The Q-Life assessment was developed to assess resilience in post-secondary students participating in the Q-Life program. Development and validation of the assessment revealed that the assessment captured broader constructs and variables of student well-being beyond resilience, not just resilience itself (Koppernaes et al., 2021). As such, the Q-Life assessment is referred to throughout this thesis as an assessment of well-being and resilience outcomes.

The first assessment, Version A (VA) was a 162-item (excluding demographic questions, risky and healthy subjective lifestyle behaviours, and open ended questions about opinions on the university) assessment of resilience-related factors such as usage of positive coping mechanisms, attitudes and willingness toward help-seeking and other individual indicators outlined by the 'National Standard' (Canadian Standards Association Group, 2020; Koppernaes et al., 2021). The 162 'resilience' items were

answered by a 5-point Likert scale of 'Never' to 'Often'. The VA assessment was developed from a literature review and expert consultation. Exploratory factor analysis, principal component analysis extraction, variance max rotation of the VA assessment revealed 18 factors – according to eigenvalues < 1 and a screed plot cut off – which accounted for 66% of the variance.

The criticism of the VA assessment was that it was too long and onerous for students to complete in a timely manner. Further expert consultation resulted in revision of several of the items and a re-alignment of how the items were thought to reflect or map onto the elements of the program curriculum. Therefore, the VA assessment was refined through further expert consultation and literature review to create the second version of the Q-Life assessment, Version B (VB). The VB assessment was a 73-item assessment still measuring resilience-related factors with the same 5-point Likert scale.

The VA assessment was developed for the V1 Q-life program. The VB assessment was developed for the V2 Q-Life program. By a technical error, the VA assessment was also integrated into the V3 Q-life program. This event presented an opportunity to compare different versions of the Q-life course content (V1 and V3) using the same assessment (VA) and also to compare the same course content (V1 and V2) with different assessments (VA and VB). To allow for comparison across the Q-Life program versions, a post-hoc score was derived from the Q-Life assessments. This post-hoc score was called the Q-Life Experience Score (QES) and was a composite score of the 'resilience' factors for both VA and VB assessments. While these factors were labelled within the program coding as resilience factors, they capture variables and constructs of both well-being and resilience. The QES for the VA assessment was derived from the original 162 items. Within those 162 items of the VA assessment, there were only 74 items which were categorized into the resilience data field, i.e., loaded onto a final 'resilience' score. Again, these factors were labelled by Q-Life programmers as resilience factors when in fact they capture variables and constructs of well-being and resilience. These 74 items were kept because they were the items carried over into the VB

assessment by JackHabbit Inc. while the other 88 were discarded. For the VB assessment, all 73 items were used by JackHabbit Inc. and the researchers to create the composite score called QES.

Within the VA and VB assessment QES items (74 for VA and 73 for VB respectively) there were 30 overlapping, verbatim items. These items were loaded onto difference factors between VA and VB assessments so another post-hoc composite score was created to compare these overlapping items across program versions: the QES Common.

To compare across program versions, the QES was converted to a percent score given that each raw QES would have different denominators for their creation. For continuity with the QES, the QES Common was also converted to percent format even though it was created from the same exact variables across VA and VB assessments. The QES and QES Common are elaborated upon in the later section where outcome variables are explained.

Q-Life Videos

Q-Life videos were 2-6 minute instructional and/or coaching videos covering core concepts of the Q-Life curriculum. There were three types of videos in all three Q-Life program versions: field expert interviews, student interviews, and coaching videos.

Q-Life V1 and V2 had VA videos. These videos were identical in content, presentation, and format. Q-Life V3 had VB videos. Between video versions A and B, the content covered the same umbrella concepts, but in novel ways, including two-dimensional animated coaching videos and new Q-life instructors and students. The goal of having new instructors and students presenting Q-Life content was to represent greater diversity, equity, and inclusiveness in Q-Life.

Q-Life Logging

The Q-Life logging was a series of 10 ‘yes’ or ‘no’ closed-ended questions which students were encouraged to complete as often as possible or as reasonable. Logging data was used to evaluate the day-to-day engagement in lifestyle behaviours and to

monitor affect and senses of coherence – all of which lend to resilience and well-being throughout the literature (Michie et al., 2011; Tal-Saban & Zaguri-Vittenberg, 2022). Logging included four lifestyle behaviour items (sleep, hydration, nutrition, and physical activity) as well as six mentality items ('feeling pumped,' 'living by vision,' 'feeling excited to start day,' 'having enough energy,' 'feeling in charge of day', and 'living by values). The logging items were distinct from the lifestyle behaviour questions included in the Q-Life assessment because they were meant to be completed on a more regular basis and they were yes/no questions of whether that behaviour was completed daily as opposed to the quality or nature of the behaviour within the past week (as with the full Q-life assessments completed approximately one month apart).

Logging questions and format was identical across all three Q-Life versions. Details on item phrasing can be found in Appendix A.

The Q-Life Companion

The Q-Life companion is a portable document format workbook with brief lessons (2–5-minute readings) across core concepts of the Q-Life curriculum followed by skill-building activities for the participant to practice. The skills to practice were directly related to the Q-Life video content as well as the Q-Life assessment content i.e., are skills related to resilience and well-being. Such skills included reflecting on identity, identifying values, drafting vision and purpose statements, creating a financial budget, and aligning daily activities with purpose, vision, and values.

To align with the changes of V1 to V2, and V2 to V3 Q-Life, the companion workbook underwent content revisions and went from VA to VB and VB to VC, respectively. Content changes included changes to topics covered (to keep up with modern research), charge activities (meant for participants to reflect and practice the skills they learn), and general language (aimed at being more inclusive of marginalized groups).

Participants

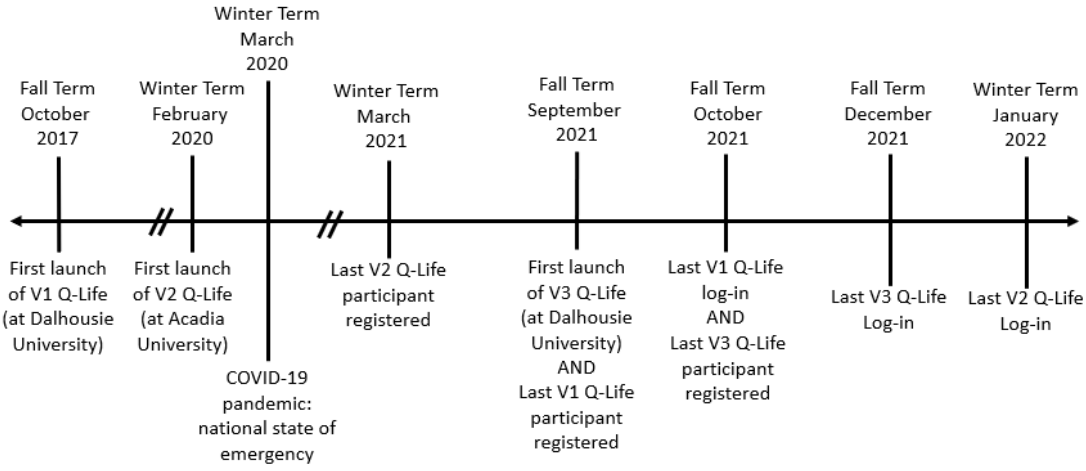
The present study used previously anonymized program evaluation data collected from October 2017 to December 2021. Data was collected by Jackhabbit Inc. throughout the implementation of the Q-Life program at Dalhousie University and Acadia University and was shared as secondary data with the researcher for this investigation.

Participant Recruitment

Participants for the present study were selected from the available datasets from Jackhabbit Inc. At the time of data collection, participants were post-secondary students at either Dalhousie University or Acadia University. Figure 11 shows the timeline of participant recruitment and program completion relative to the COVID-19 pandemic shutdowns in North America.

Figure 11

Timeline of Participant Uptake and Program Completion



Note. The spacing of events on the timeline are not proportional to the amount of time passing. The diagonal dashes across the timeline indicate a significant passing of time (≥1 year).

Expansion of Initial Dataset to Allow for Subgroup Comparison

In the initial dataset, before extension of the recruitment timeline as is shown in figure 11, there were only V1 and V2 Q-Life participants (N=454). Participants from V1 Q-Life were all students at Dalhousie University (n=174) and V2 Q-Life participants were all from Acadia University (n=280). This initial dataset was small and had highly uneven group sizes. Figure 12 breaks down subgroups and group sizes across the two independent variables of program version and COVID-19 impact. This smaller sample would offer no statistical power in comparisons of subgroups. As such, the third research question could not be explored in terms of effectiveness compared across program version. For this reason, the sample size was expanded to encompass two additional groups as is shown in figure 13: one that already existing within the data (tagged as a "pilot group" of students) and the other that was added by Jackhabbit Inc. in a new data extraction after the implementation of a third version of the Q-Life program (a 'V3' group all from a single academic course at Dalhousie University). The new subgroup breakdown of sample sizes after this expansion is outlined in figure 13.

Figure 12

Breakdown of Participant Subgroups Prior to Sample Expansion

V1 and V2 Data Total N=454 pre; Total n=173 post	Dalhousie students Version 1 program and assessment n=174 pre; n= 46 post	Acadia students Version 2 program and assessment n=280 pre; n=127 post
A) Completed both pre and post before Covid-19 emergence (pre-March 2020) n= 11	Subgroup 1A (SG1A) n= 11	Subgroup 2A (SG2A) n= 0
B) Completed pre before (pre-March 2020) and post after emergence of Covid-19 (March 2020 onward) n= 84	Subgroup 1B (SG1B) n= 11	Subgroup 2B (SG2B) n= 73
C) Completed pre and post both completed after emergence of Covid-19 (March 2020 onward) n= 78	Subgroup C1 (SGC1) n= 24	Subgroup C2 (SGC2) n= 54

Note. V1 and V2 indicate Versions 1 and 2 of the Q-Life programs respectively. Dalhousie indicates Dalhousie University and Acadia indicates Acadia University. N indicates overall sample size while n indicates a subgroup of the sample size.

Figure 13

Breakdown of Program Version and COVID-19 Subgroups Used for the Study

V1, V2, & V3 Data Pre: 1076; Post: 424	Dalhousie + pilot students Version 1 program, V1 assessment n= 626 pre; n= 226 post	Acadia students Version 2 program, V2 assessment n=280 pre; n=127 post	Dalhousie students Version 3 program, V1 assessment n=170 pre; n=71post
A) Completed both pre and post before Covid-19 emergence (pre-March 2020) n= 185	Subgroup 1A (SG1A) n= 185	Subgroup 2A (SG2A) n= 0	Subgroup 3A (SG3A) n=0
B) Completed pre before (pre-March 2020) and post after emergence of Covid-19 (March 2020 onward) n= 90	Subgroup 1B (SG1B) n= 17	Subgroup 2B (SG2B) n= 73	Subgroup 3B (SG3B) n= 0
C) Completed pre and post both after emergence of Covid-19 (March 2020 onward) n= 149	Subgroup 1C (SG1C) n= 24	Subgroup 2C (SG2C) n= 54	Subgroup 3C (SG3C) n= 71

Note. V1, V2, and V3 indicate Versions 1, 2, and 3 of the Q-Life programs respectively. Dalhousie indicates Dalhousie University and Acadia indicates Acadia University. Pilot indicates Dalhousie students that were engaged in the very first implementations of Q-Life. N indicates overall sample size while n indicates a subgroup of the sample size. Grey cells indicate subgroups impacted by the COVID-19 pandemic.

According to Jackhabbit Inc., the pilot group is a set of data from before JackHabbit Inc. differentiated schools in data collection. Pilot data is made predominantly of Dalhousie University students recruited through word of mouth and on-campus advertising. Some students from other Canadian universities Queen's and University of British Columbia were included in pilot data but made up no more than 1% of the pilot group. These participants were de-identified prior to the present study.

The expansion of the dataset also allowed for better comparison of COVID-19 subgroups to investigate the third research question of whether Q-Life effectiveness changed during the pandemic. The greyed-out subgroup cells in Figure 13 indicate the group that was impacted by the COVID-19 pandemic. Where B and C subgroups were too small and uneven when also split by program version, the researcher decided to group SG1B, SG2B, SG3C, SG1C, SG2C, and SG3C into one "COVID-19 impacted group" (n=239) to answer the third research question of whether Q-Life effectiveness changed

during the pandemic. To do this, there was an assumption which had to be met first: Q-Life changes from pre to post had to be similar enough across Q-Life Version subgroups that participants could be re-grouped into independent groups of COVID-19 impact rather than divide by Q-Life program version and COVID-19 impact and create sub-groups too small to hold any statistical power in comparative analysis. For this reason, this research question was investigated after the comparison of subgroups across program version. Details as to how each research question will be answered are explained in further sections.

Inclusion and Exclusion Criteria

Participants were included if they were tagged in the secondary data as being post-secondary students. An initial total of 1,116 participants were in the anonymized dataset shared by Jackhabbit Inc. Within that dataset, 22 participants were labelled as non-students (i.e., school or Jackhabbit Inc. employees), and 18 lacked so much data that they could not be grouped. These 40 participants were removed from the dataset. Figure 14 outlines participant inclusion from the raw secondary dataset.

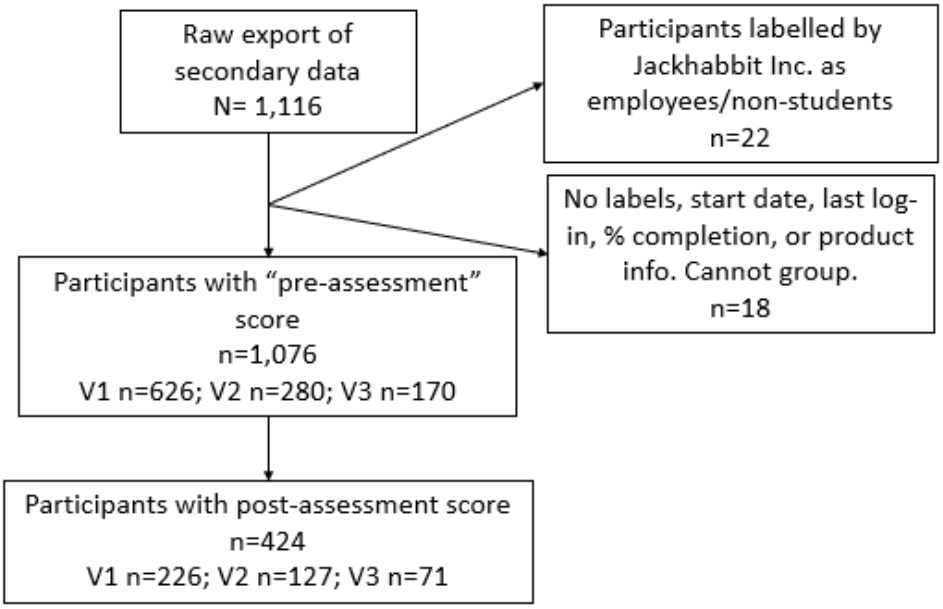
Participant required a pre and post score for analyses of outcomes and so those with only one assessment score were excluded from analyses. Overall, 1,076 participants were tagged as post-secondary students with T1 assessment data. Of those who had T1 assessment data, 58% (n=628) were from Q-Life V1, 26% (n=280) were from Q-Life V2, and 16% (n=168) were from Q-Life V3. Of the 1,076 participants with pre assessment data, 39% (n=424) also had post assessment data and could be included in analyses. Of the 424 student participants with pre and post assessment data, 53% (n=226) were participants of Q-Life V1, 30% (n=127) were participants of V2 Q-Life, and 17% (n=71) were participants of V3 Q-Life.

Those with pre and post assessment scores were included regardless of the degree of their engagement with the Q-Life program. In other words, even those with “0% program completion” were included for analysis, because although they engaged with none of the video lesson content the participant could complete other components

of the Q-life such as review the student companion and complete skill building activities, and therefore were included for analysis. Despite attempts to recruit a control group that completed only the pre-and post-assessments and had no involvement with the Q-life whatsoever, only 7 participants were recruited as controls over 2 years, and therefore were not included the data or this analysis.

Figure 14.

Overview of Participant Inclusion



Note. 'V1', 'V2', and 'V3' indicate participation in Q-Life version 1, 2, and 3, respectively. 'N' is the total number of participants in the sample while 'n' indicates a subset group of the sample.

Evaluation Design and Procedures

Evaluation of the Q-Life program incorporates dimensions of the RE-AIM implementation framework: specifically, reach and effectiveness (Glasgow et al., 1999; Holtrop et al., 2021). RE-AIM is a part of the integrated RE-AIM and PRISM framework from implementation science; it is designed to guide the improvement of adoption and sustainability of evidence-based interventions for program planners, evaluators, and the like (Glasgow et al., 2019; RE-AIM.org, n.d.). RE-AIM stands for reach, effectiveness, adoption, implementation, and maintenance. The framework outline can be found in

Appendix B. Program reach is defined as the absolute number, proportion, and representativeness of individuals who are willing to participate, and the reasons why or why not (RE-AIM.org, n.d.). Program effectiveness is defined as the impact of an intervention on important individual outcomes, including potential negative effects, and broader impact including quality of life and economic outcomes; and variability across subgroups (generalizability or heterogeneity of effects)" (RE-AIM.org, n.d.).

To get a stronger understanding of effectiveness and reach, outcome measures were evaluated across several independent variables, outlined below.

Independent Variables

Time.

The first independent variable was that of time. Students completed the Q-Life assessment twice, approximately one month apart and the time (date) which they completed the assessment was taken. From each assessment, outcome variables of QES and QES Common were obtained. Comparing T1 to T2 QES and QES Common was the primary reason for collecting assessment time. Time between assessments was not controlled for, though the recommended timeline was one month. Within the 424 participants with pre and post data, there were several extreme outliers on both the high and low end (minimum 0 and maximum 1,062) which had unrealistic data in the 'time to complete' difference between T1 and T2. The 5% trimmed mean for 'time between T1 and T2 (in days)' was 41 (SD±75), the median was 37 (interquartile range 22), and the mode was 30 days between T1 and T2 assessments.

Q-Life Program Version.

The Q-Life program version subgroup was, as previously described in the 'participant subgroups' section, determined by when and where the student participated in the Q-Life program. Theoretically, these groups were mutually exclusive since the program versions occurred at distinct time periods and/or different institutions. Where V1 and V2 of the Q-Life program both occurred at Dalhousie University, the V3 group were primarily first-year students participating in a first-year

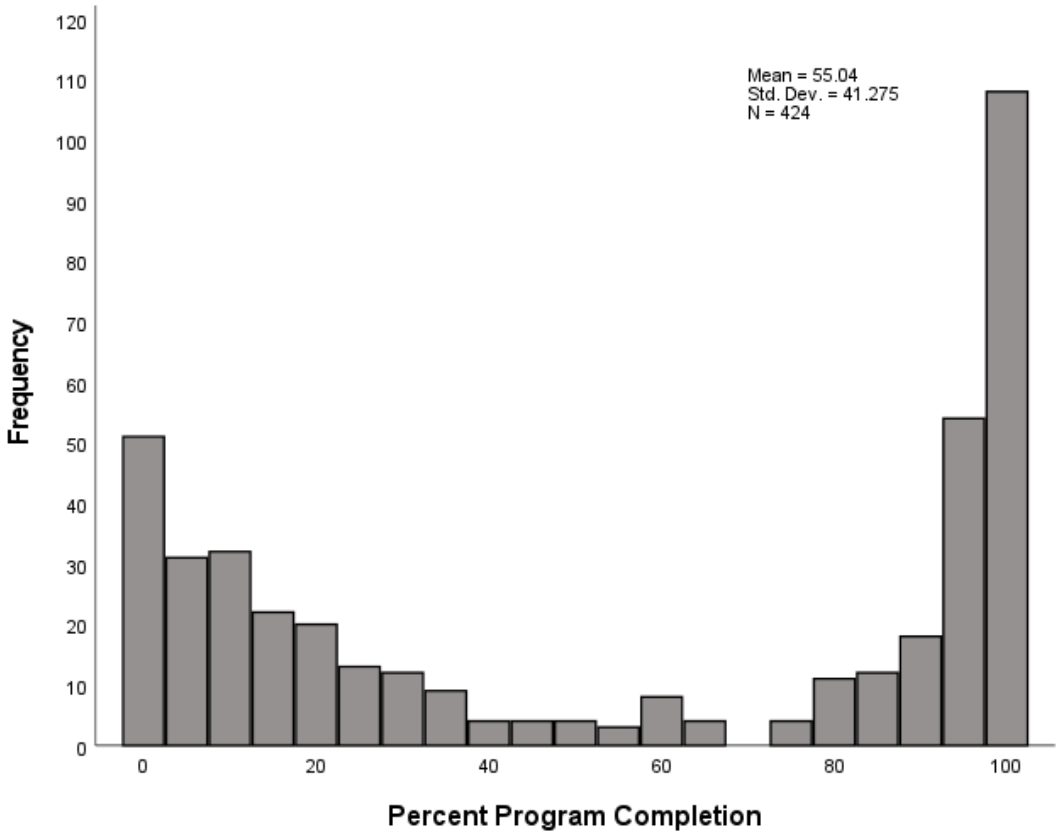
course. With the program evaluation data being anonymized prior to the researcher's retrieval of it, there is no way of knowing for certain if these groups were independent. That said, where it was probable that they were independent, they were treated as such in data analyses. As an example of this probability, it is unlikely that a participant was a student at Dalhousie University and Acadia University simultaneously, and it is unlikely that a participant was a Dalhousie student in 2017 and a first-year student in 2021.

Percent Program Completion.

Also referred to as percent completion or percent product completion (note only referring to the percent of Q-Life videos completed), this specific part of engagement data was used to group participants and investigate a dose response in answering whether Q-Life was effective. The distribution of percent program completion for those who had both pre and post assessment data (n=424) is shown in Figure 15.

Figure 15

Percent Program Completion Distribution of Pre and Post Participants



Note. Std. Dev. indicates standard deviation. N indicates sample. n=33 for the 0% completion group (i.e., the 'none' group who participated in no video content). Percent Program Completion refers to percent program completion.

The 424 participants were grouped into three categories independent of other subgroups: those with 0% program completion (i.e., did not engage or the 'none' group, n=33), those with 1-32% program completion (those with 'some' engagement, n= 151), and those with ≥33% program completion (those with 'more' engagement, 240).

Rather than evenly sized tertials, the group was divided into groups based on theoretical differences from someone who does not engage at all ('none') versus someone who engages even a little bit ('some') and versus someone who engages in a third or more of the program ('more'). This method of grouping was also due to the fact that greater incentivization of the V3 Q-Life program group meant that participants in the 80%+ participation range were predominantly V3 Q-Life participants. The "none,

some, and more" grouping method was, as such, partly intended to counteract mislabeling a possible program/participant difference effect as a participation effect.

COVID-19 Impact.

In the Canadian Maritime provinces, COVID-19 lockdowns started early March of 2020. The COVID-19 pandemic was an uncontrollable effect that needed to be accounted for and could not be controlled for given the secondary nature of the data, the implementation timeline, and the need to include a larger sample and be able to divide data into subgroups by program version. Investigating the possible impact of COVID-19 on student well-being and resilience had to be incorporated into the research design and deliberately explored. Participants were hence categorized as either COVID-19 impacted (any participant with at least one Q-Life assessment that occurred during or after March 2020) or COVID-19 unimpacted (any participant who had all assessments completed prior to March 2020). These groups were treated independently though it is important to note that with previously anonymized data, there is no way of being certain that a student did not participate in the program first before COVID-19 and then again after. For the same reasons as outlined in the program version subgroup section, these groups were treated independently for data analyses.

Demographic Data.

Gender identity and racial identity were two demographics that were used to categorize participants to determine whether Q-Life was effective across gender groups and racial identities.

In the V1 Q-Life assessment, participants could select a gender from options 'female', 'male', 'other', 'unspecified', or 'prefer not to answer'. In the V2 Q-Life assessment, participants could select gender from options 'female', 'male', 'non-binary or third gender', 'prefer to self-describe', or 'prefer not to answer'. Due to these discrepancies and the small sample size of those who identified as neither 'female' nor 'male' for either assessment version, these groups were collapsed for analysis. In the V1 assessment responses, those who identified as 'other' (n=11) or 'unspecified' (n=2) were

combined into a group called ‘other’. In V2 assessment responses, those who identified as ‘non-binary or third gender’ (n=3) were relabelled as ‘other’ and those who selected ‘prefer to self-describe’ (n=0) or ‘prefer not to respond’ (n=1) were collapsed into ‘prefer not to answer’ (PNA).

In the V1 Q-Life assessment, participants could select one racial identity as ‘Caucasian (white)’ ‘Aboriginal’, ‘east Asian’, ‘south Asian’, ‘southeast Asian’, ‘west Asian or Arab’, ‘Latin, south or central American’, ‘other’, or ‘choose not to answer’. In V2 Q-Life assessment, participants could respond to the question:

> “Do you consider yourself to be a racialized person? For the purposes of this survey, racialized persons are people (other than Aboriginal/Indigenous persons) who are non-white in colour and non-Caucasian in race, regardless of their place of birth or citizenship. (Sometimes referred to as ‘racially visible’ or ‘visible minority.’)”

in either the affirmative, negative, or ‘prefer not to answer.’ Due to these discrepancies, responses that were not ‘Caucasian (white) from the V1 assessment data were collapsed into a ‘non-Caucasian/white’ category.

Outcome Measures

Participant Engagement.

The Kajabi.com platform that hosted Q-life had some metrics that identified how much users engaged with the program; however, this platform did not allow infinite use data to fully describe the typical student experience with the platform such as time spent journaling, time spent video watching, or use of other features such as the logging and journaling feature, or the companion skill-building activity workbook. Therefore, three methods were identified to act as surrogates to evaluate participant engagement: percent program (i.e., video completion), login count, and logging entry count. While percent program completion was an independent variable for some analyses, engagement was also an outcome when comparing across program version and demographics.

It is important to note that product completion refers only to the percent of video content that participants clicked on and viewed. Percent completion does not account for how much a participant interacted with the Kajabi system (the online content delivery platform) as a whole or any other program content. Theoretically, participants could skip to the end of a video after loading it and the Kajabi system would still mark the video as completed. Further, percent completion does not account for whether a participant reviewed video content or, if they did, how many times. Percent completion is not an indicator of learning or information absorption and retention.

Login count refers to the number of times a participant logged into their Kajabi account. It does not refer to how much the participant engaged with the available content upon logging in.

Logging entry count refers to the number of times that a participant clicked on the logging tool and entered any data at all. It does not indicate how many of the logging questions that a participant responded to, or whether the participant entered a coherent response. For instance, a non-sensical response such as entry of random characters in the open-ended questions would be counted as one logging entry. This important to note because this investigation only analyses the quantitative responses to 10 logging items, it does not analyse qualitative responses, even though the entry of a qualitative response without any quantitative responses would count as a logging entry.

Q-Life Experience Score and Q-Life Experience Score Common.

The QES is a percent score that was created post-hoc to compare Q-Life program versions. For participants with VA assessment data (those participating in V1 and V3 of Q-Life), the QES is the percent of a 74-items composite score. These items came from the 'resilience' and 'additional' data fields of the VA assessment. On VA, one could achieve a maximal score of 370 as each of the 74 items used a 5-point Likert scale. For participants with VB assessment data (those participating in V2 of Q-Life), QES is made up of 73 assessment items. These items came from the 'resilience' data field – which

made up the entire VB assessment. On VB, one could achieve a maximal score of 365 as each of the 73 items used a 5-point Likert scale.

All 30 of the common items between VA and VB assessments are included in the QES and were used to create another post-hoc composite score called QES Common.

The full details of the QES and item phrasing will not be shared due to copyright. But elements of the QES represented self-awareness, self-appraisal, purpose, vision, values, gratitude, social connection, and more. Details as to the QES Common can be found in Appendix C.

Dealing with Outliers

Outliers were generally retained throughout analyses of the present study. The primary reason for retaining them was that, unless otherwise noted, outliers were not experimenter errors and were likely reflective of natural variability. Further, because the QES is a snapshot of the overall Q-Life assessment and of student well-being and resilience, there was no way of being certain that outlier responses were intentional misreporting from participants. Furthermore, where sub-groups were already small and unbalanced, the removal of outliers could also reduce the statistical power of comparative analyses. For these reasons, the researcher believes that data integrity was better maintained by being transparent about outliers and how they were identified, while leaving them in.

It is recognized that outliers can bias both descriptive and inferential statistics (leading to increased risk of Type 1 or Type 2 error) and limit statistical power for parametric tests (Burke, 1998; Valentine et al., 2021). To mitigate this drawback, statistics that are more robust to outlier pull - such as medians and interquartile ranges (Burke, 1998) - are included to better understand central tendencies.

Data Analyses

The purpose of this research is to evaluate the Q-Life program to make program development recommendations that drive the Q-Life program toward being an effective and accessible service that post-secondary institutions can incorporate into campus supports as part of their efforts of meeting the National Standard for Mental Health and Well-being for Post-secondary Students (Canadian Standards Association Group, 2020).

To achieve this purpose, the Q-Life program requires on-going evaluation so that program development stays evidence-informed. Hence, the present action-research study is an evaluation aimed at answering the following questions:

4. Is Q-Life effective at helping students with pre to post improvement in well-being and resilience? To assess this,
    a. A paired sample t-tests and non-parametric sign test was run on QES to assess overall effectiveness
    b. A two-way mixed factorial ANOVA was completed on QES and QES Common to assess effectiveness over time between versions. QES and QES Common results were compared to check for internal consistency.
5. Does level of engagement influence the effectiveness of the Q-Life program and/or does participation in elements of the Q-Life program related to Q-Life outcomes? To assess this,
    a. A spearman rank-order correlational test between the engagement element of percent program completion and difference between T1 and T2 QES
    b. A two-way mixed factorial ANOVA of QES by percent product completion and time was used to determine if Q-Life's effectiveness was influenced by engagement
    c. A hierarchical multiple regression was used to determine the degree to which three models were predictive of T2 QES.
6. Are there differences in effectiveness across program version or COVID-19 subgroups and were there any differences in demographic reach across program versions? To assess this,
    a. A two-way mixed factorial ANOVA on QES by time and program version was revisited and a two-way mixed factorial ANOVA on QES by time and COVID-19 impact was run.
    b. A Kruskal-Wallis H test was run to check for difference between groups and investigate differences in program reach.

c. Four separate MANOVAs were completed for Q-Life V1 and V3, by gender and then by race to evaluate differences in reach.

Answering Research Question One: Q-Life Effectiveness

Effectiveness was evaluated by comparing T1 and T2 QES for statistically significant differences (α=0.005). Effectiveness of a health intervention, in contrast to efficacy, includes non-compliant participants to reflect more "real-world", clinical relevance (Page, 2014). As such, the effectiveness analysis was run using all participants with pre and post data (n=424), regardless of engagement. In other words, participants with both pre and post data from subgroups 1A-1C, 2A-2C, and 3A-3C were all used in the first analysis of effectiveness.

T1 QES were normally distributed as confirmed by a Shapiro-Wilk's test (p= 0.275) and both skewness and kurtosis being within the accepted ±2.58 z-score for the 424 participants with pre and post data. T2 QES were *not* normally distributed in those same participants, as confirmed by a Shapiro-Wilk's test (p=0.03), a significant skewness of -0.271 (SE = 0.119) and kurtosis of -0.353 (SE = 0.237).

Difference between T1 and T2 QES was non-normal. Several outliers were detected that were more than 1.5 box-lengths from the edge of the box in a boxplot. The distribution showed skewness of 0.676 (SE = 0.119) and kurtosis of 1.095 (SE = 0.237). Shapiro-Wilk's test again confirmed a non-normal distribution (p= 3.6279E-7).

Paired sample t-tests are considered robust to mild violations of normality with respect to a Type 1 error. That said, the non-parametric sign test was also completed to compare to the parametric paired samples t-test comparing QES across time. Both tests were completed to determine whether the parametric test and non-parametric test options revealed the same conclusions about the results despite the outliers being kept in the data. If they did, then parametric tests could be considered for other analyses.

A mixed factorial ANOVA was run for QES by time and Q-Life program version. While sub-group differences were explored to answer research question three, within group differences were explored as another indicator of effectiveness. For this statistical

test, participants of subgroups 1A-1C (n=226) were compared to subgroups 2A-2C (n=127) and 3A-3C (n=71) and vice versa.

A mixed factorial ANOVA was also run for QES Common by time and Q-Life program version to compare to the same test performed with the QES across program version. For the mixed factorial ANOVA with QES Common, the same participants as the mixed factorial ANOVA on QES were compared (i.e., subgroups 1A-1C versus 2A-2C versus 3A-3C). The purpose of comparing QES Common, a subset of the QES, over time and program version was to complete a sort of internal validity check. Similar results between QES and QES Common would indicate that the elements retained from assessment VA to VB were correctly selected for their perceived importance for well-being and resilience and that the other 43 to 44 items which made up QES in VA and VB, while aligned with the 30 common factors, are not necessary to retain in analysis. Should QES and QES Common results vary by interaction effect, simple main effects, or main effects, then the 43 to 44 non-common QES items would be important to keep in analysis. It is hypothesized that the version effects will be similar for QES Common as they were QES.

Answering Research Question Two: Influences on Q-Life Effectiveness

A spearman rank-order correlational test between the engagement element of percent program completion and difference between T1 and T2 QES was used investigated to identify the possibility of a Q-Life dose effect such that greater engagement positively impacted Q-Life effectiveness (α=0.005). This non-parametric test was run due to the absence of normality between 'T1 and T2 difference in QES' data and 'percent program completion' data; the absence of a linear relationship between 'T1 to T2 Difference in QES' and 'percent program completion'; and the presence of a monotonic relationship between T1 to T2 QES difference and percent program completion.

As well, a two-way mixed factorial ANOVA of QES by percent product completion and time was used to determine if Q-Life's effectiveness was influenced by engagement. Both analyses grouped participants by percent program completion as those with no

percent program completion, those with some, and those with more. These independent groups were formed separate from program version and COVID-19 impact groups using the same 424 participants with pre and post QES data.

A hierarchical multiple regression was used to determine the degree to which three models were predictive of T2 QES. The first model was the T1 QES score, i.e., the level of well-being and resilience a student is joining the program from. The second model included the frequency which a participant reported 'yes' in the Q-Life logging that they engaged in positive lifestyle behaviours of sleep, hydration, nutrition, and physical activity on that same day of logging. The third model analysed added the frequency which a participant reported 'yes' in the Q-Life logging that they experienced positive mentalities that same day of logging.

Answering Research Question Three: Subgroup Differences in Effectiveness and Reach

Descriptive statistics were run on participant age, gender, and racial group and were analysed first to understand the demographics of the sample and frame subsequent analyses of effectiveness and reach of the Q-Life program.

To investigate how Q-Life effectiveness may have varied across the Q-Life program versions, the same two-way mixed factorial ANOVA on QES by time and program version as was run before was revisited. This analysis compared subgroups 1A-C (n=226), 2A-2C (n=127), and 3A-3C (n=71).

Should program version have an insignificant main effect, then participants can be regrouped per other COVID-impact for other analyses. Assuming this is the case, another two-way mixed factorial ANOVA would be run on QES by time and COVID-impact to answer the third research question. This analysis compared subgroups 1A-3A (n=185) with the combined groups of 1B-3B and 1C-3C (n=239).

To investigate differences in program reach, other difference between groups tests were run. Given the and non-normally distributed data, the non-parametric Kruskal-Wallis H test (also known as the one-way ANOVA on ranks test) was run and group medians were used to compare engagement across Q-Life versions 1, 2, and 3

(i.e., comparing results with sign-in count, log in count, and percent program completion data from subgroups 1A-C, 2A-2C, and 3A-3C). Participants were included in analyses regardless of whether they had pre and post Q-Life assessment results or only pre. The reason for this is because overall participation in the Q-Life experience is not exclusive to the assessment. Only Q-Life version subgroups were compared because the goal is to understand differences in program implementation across program iterations rather than across the uncontrollable COVID-19 pandemic. The null hypothesis of the Kruskal-Wallis H test is that the distribution and medians of engagement scores for the different Q-Life program versions are equal. For all elements of engagement (i.e., sign-in count, log entry count, and percent program completion), pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Adjusted p-values are presented.

To investigate whether participant demographics varied by participant program version, a MANOVA was completed for Q-Life V1 and V3 - i.e., drew from subgroups 1A-1C (n=626) versus 3A-3C (n=170) - first by gender and then by race for a total of four separate MANOVAs. Only Q-Life version subgroups were compared because the goal is to understand differences in program implementation across program iterations rather than across the uncontrollable COVID-19 pandemic. Only V1 and V3 program versions of Q-Life were used for this analysis because they shared the same VA assessment and had the most differences in program content. This analysis allowed for a deeper understanding of whether the different program versions were reaching and including different demographic groups. Participants were included in analyses regardless of whether they had pre and post assessment results or only pre. The reason for this is because overall participation in the Q-Life experience is not exclusive to the assessment. Moreover, the goal of this analysis was to understand demographic differences in reach, a separate concept from program effectiveness over time.

Chapter 4: Results

Research Question One: Q-Life Effectiveness

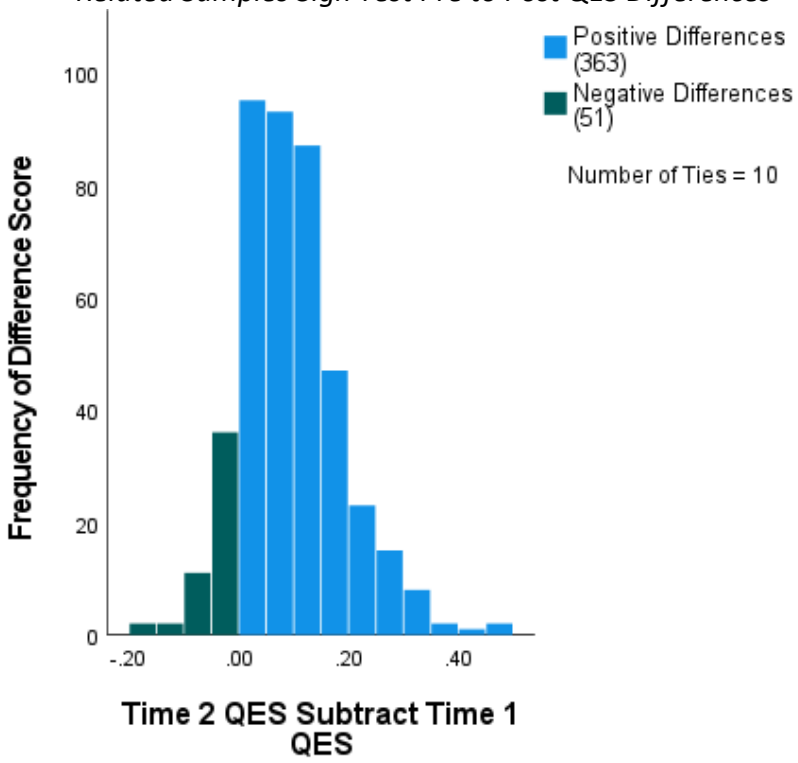
QES was measured pre-program and post-program. A paired t-test was performed comparing T1 and T2 QES. Participants achieved higher QES at T2 (mean 74.5% ± SD 11.1%) than T1 (mean 65.3% ± SD 9.4%). QES showed a statistically significantly mean increase from T1 to T2, M = 9.2%, 95% CI [8.3%, 10.2%], t(423)=20.0, p= 4.6E-63, Cohen's d = 0.97. There was a statistically significant difference between means, as indicated by p-values and effect size.

A related samples sign test with continuity correction was conducted to determine effects of Q-Life on QES (figure 16). Of the 424 participants with T1 and T2 data, the majority (N=363) saw an improved QES in T2 as compared to T1. Others (N=51) saw a decrease in QES or no change in score (N=11). For the 424 participants with pre and post data, the median for T1 and T2 QES was 66% and 75% respectively. Participants scored higher at T2 than T1, i.e., there was a median increase in the differences of 8.1% (N=424). Results are depicted in figure 16. There was a statistically significant median difference in QES from T1 to T2, z=15.29 p<0.005.

The number of participants whose QES scores improved over time was about 7 times the number of participants who declined in QES over time. Interestingly, the magnitude of T1 to T2 difference was greater for the 'improvement' group than it was for the 'decline' group. While the mean T2 QES was greater than T1 QES by 11 points (a percent change of approximately 17%) in participants whose score improved, the mean QES from T1 to T2 went down by 5 points (a percent change of negative 6%) in the group who declined. Table 2 outlines these differences and compares to the group with only pre-assessment data.

Figure 16.

Related Samples Sign Test Pre to Post QES Differences



Note. QES denotes Q-Life Experience Score; QES is a percent score denoted here in decimal form. The difference from Time One to Time Two in QES is depicted along the x-axis, and the frequency of that difference occurring is denoted in the y-axis. The number of positive differences, in light blue, indicate that QES increased over time for most cases. Negative differences on the left, in dark green, indicate instances where participants' score decreased from Time One to Time Two. Ties indicate where there were no changes from Time One to Time Two, but are not depicted with bars on the chart, rather are noted in the key.

Table 1

Comparing QES By Time One to Time Two Categorical Differences

		Time One QES	Time Two QES
Only one assessment	n	652	
	Mean (±SD)	65% (±11%)	
	Median (IQR)	65% (13%)	
	Std. Error of Mean	4.1%	
	Minimum	29%	
	Maximum	99%	
Pre to post decrease	n	51	51
	Mean (±SD)	69 % (±11%)	65% (±10%)
	Std. Error of Mean	1.5%	1.4%
	Median (IQR)	70% (13%)	65% (13%)
	Minimum	46%	45%
	Maximum	92%	90%
No change pre to post	n	10	10
	Mean (±SD)	71% (±7.5%)	71% (±7.5%)
	Std. Error of Mean	2.4%	2.4%
	Median (IQR)	70% (12%)	70% (12%)
	Minimum	57%	57%
	Maximum	81%	81%
Pre to post increase	n	363	363
	Mean (±SD)	65% (±9%)	76% (±11%)
	Std. Error of Mean	0.48%	0.56%
	Median (IQR)	65% (12%)	76% (15%)
	Minimum	32%	45%
	Maximum	88%	99%

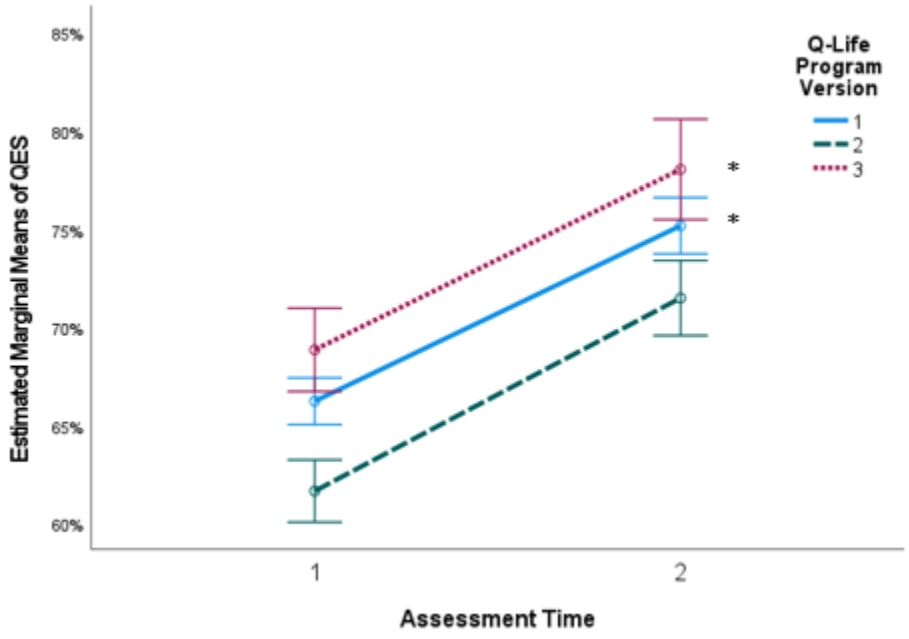
Note. Total N = 1076 with Time One assessment data and n = 424 with Time One and Time Two assessment data. QES stands for Q-Life Experience Score, and it is a percent score. SD denotes Standard Deviation. Std. denotes 'standard'. IQR denotes interquartile range.

Q-Life effectiveness is again confirmed through a two-way mixed factorial ANOVA (figure 17). There was a highly significant main effect of time on QES, $F(1, 421) = 325.554$, $p = 2.51E\text{-}54$, partial $\eta^2 = 0.436$. T2 had a mean QES 9.3%, 95% CI [0.083, 0.103] higher than T1, a significant difference, $p = 2.51E\text{-}54$.

While there were significant main effects of program version (p = 3.1009E-7), all three Q-Life versions had similar effectiveness (figure 17) as there was no interaction effect between time and version (p = 0.697). Subsequently, participants could be regrouped by COVID-19 impact in later analyses and the researcher could proceed with answering the third research question more completely. Detailed results comparing program versions follow later in the results section where subgroup differences in effectiveness are discussed. Analysis details of the two-way mixed factorial ANOVA of QES by time and version can be found in Appendix D.

Figure 17

Estimated Marginal Means of QES by Q-Life Version and Time



Note. N= 424 for those with pre and post assessment data (n=226 in V1 Q-Life, n=127 in V2, and n=71 in V3). QES denotes Q-Life Experience Score, and it is a percent score. Error bars denote 95% confidence intervals. All three program versions showed that Time Two QES was significantly higher than Time One QES, with a difference of about 9%. There was a main effect for program version. Asterisks (*) indicates a significant difference from V2. There was no significant interaction effect on QES from time and program version.

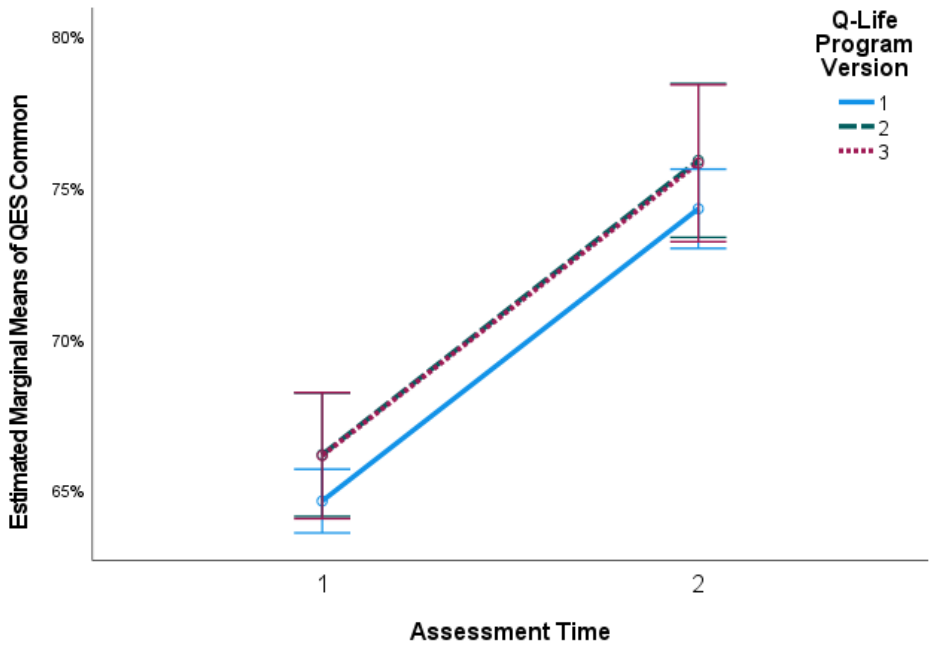
Q-Life Experience Score Common Items

The 30 common items across the V1 and V2 QES were extracted to create a composite score called the 'QES Common'. The purpose of creating and investigating this post-hoc score was to answer whether the non-common 43 to 44 assessment items needed to be retained in the present study analyses.

A two-way mixed factorial ANOVA was run to determine if there were significant QES Common differences between those of different program versions and/or time. Results of which are identified in figure 18.

Figure 18

Estimated Marginal Means of QES Common by Version and Time



Note. N= 424 for those with pre and post assessment data (n=226 in V1 Q-Life, n=127 in V2, and n=71 in V3). QES denotes Q-Life Experience Score, and it is a percent score. Error bars denote 95% confidence intervals. All three program versions showed that Time Two QES was significantly higher than Time One QES, with a difference of 9.7%. There were no significant main effects for program version or interaction effects.

QES Common Score was mostly normally distributed, as assessed by Shapiro-Wilk's test *(p* > 0.05) and normal Q-Q plots. There was one outlier, which had a studentized residual value of 3.30. There was a violation of the assumption of homogeneity of covariances, as assessed by the Box's test of equality of covariance matrices *(p* = 0.009). This violation is notable, but the ANOVA is relatively robust to this violation and the analysis can be run regardless. There was homogeneity of variances for T1 QES Common Score, as assessed by Levene's tests of homogeneity of variance *(p* > 0.05). For T2, however, the assumption of homogeneity of variances was violated. Mixed ANOVAs are not robust to violations of this assumption. For curiosity's sake, this analysis was continued, but it is important to note this major violation.

There was a significant main effect of time in mean QES Common at the different time points, *F*(1, 420) 270.966, *p* = 2.44E-47, partial η^2 = 0.392. T2 had a mean QES Common 9.7%, 95% CI [0.085, 0.108] higher than T1 (p = 2.44E-47). There was no statistically significant difference in QES Common by Q-life version, *F*(2, 420) 1.464, *p* =0.233, partial η^2 = .007. There was no statistically significant interaction between the time and Q-Life version on QES Common, *F*(2, 420) = 0.001, *p* = 0.999, partial η^2 = 6.00E-6. Statistical details of the two-way mixed factorial ANOVA of QES Common by time and version can be found in Appendix E. Where these results vary from QES results, QES Common was not used for other analyses.

Research Question Two: Influences on Q-Life Effectiveness

Percent Product Completion

A Spearman's rank-order correlation was run on all 424 participants with calculatable difference between T1 and T2 QES data. There was a weak but statistically significant, positive correlation between difference between T1 and T2 QES and percent product completion, r_s (422)= .194. p = 0.000059.

Table 3 below compares QES from T1 to T2 by categorical percent product completion. Those who had no product completion (i.e., did not engage with any video

content) appear to have had similar changes in QES over time to those who completed in 'some' or 'more' of the Q-Life video content.

Table 2

Comparing QES from T1 to T2 by Categorical Percent Product Completion

		Time One QES	Time Two QES
0% product completion ('none')	n	33	33
	Mean (±SD)	64% (±8.7%)	75% (±11%)
	Median (IQR)	64% (17%)	77% (19%)
	Minimum	50%	56%
	Maximum	78%	96%
1-32% product completion ('some')	n	151	151
	Mean (±SD)	63% (±9.4%)	74% (±12%)
	Median (IQR)	64% (11%)	75% (16%)
	Minimum	32%	45%
	Maximum	86%	98%
≥33% product completion ('more')	N	240	240
	Mean (±SD)	66% (±9.5%)	75% (±11%)
	Median (IQR)	67% (12%)	75% (15%)
	Minimum	38%	45%
	Maximum	92%	99%

Note. Total N = 1076 with Time One assessment data and n = 424 with Time One and Time Two assessment data. QES stands for Q-Life experience Score, and it is a percent score. SD denotes Standard Deviation. IQR denotes interquartile range.

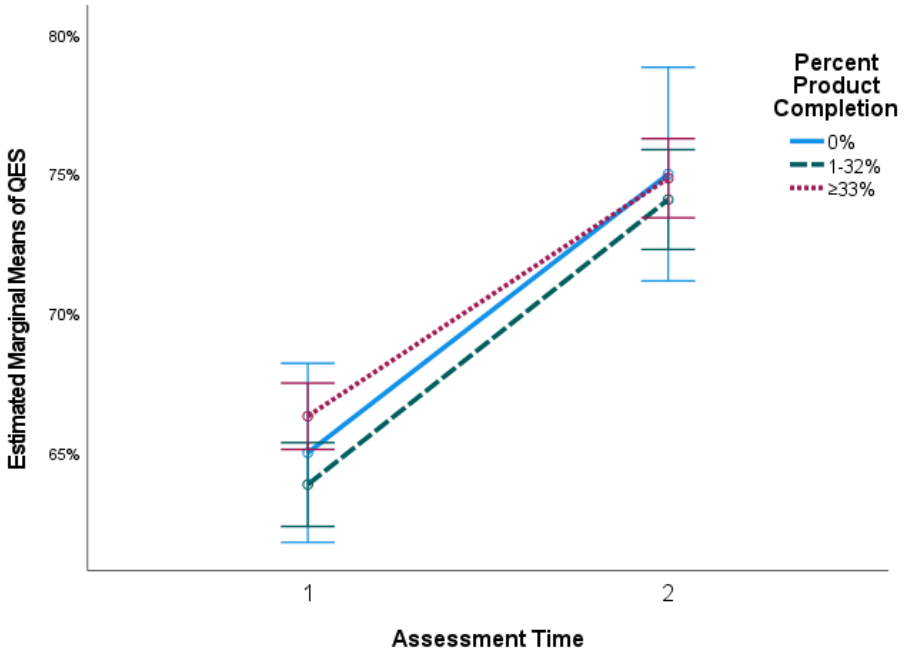
As well, a two-way mixed factorial ANOVA was run by time and percent product completion (figure 19) for the 424 participants with pre and post QES data. Three groups were created for participants (independent of program version and COVID-19 impact) with both pre- and post-assessment QES: those with 0% product completion (n= 33), those with 1-32% product completion (n=151), and those with ≥33% product completion (n=240). There were several outliers, as assessed by boxplot and two outliers assessed by examination of studentized residuals for values greater than ±3. The data was mostly normally distributed, as assessed by Shapiro-Wilk's test of normality *(p* > .05). Exceptions to this were T1 0% completion group *(p* = 0.03) and T2 ≥33% group *(p* = 0.04). Assessment of Normal Q-Q plots revealed reasonable alignment along the diagonal with deviation that ANOVAs are robust enough to. There was homogeneity of

variances (p > .05) and covariances (p > .001), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively.

There was a significant main effect of time on mean QES across completion groups, $F(1, 421) = 222.164$, $p = 1.20E\text{-}40$, partial $\eta^2 = 0.345$. T2 had a mean QES 9.6%, 95% CI [0.083, 0.108] higher than T1, (p = 1.20E-40). There was no statistically significant difference in mean QES between percent product completion groups, i.e., no significant main effect for different completion groups, $F(2, 421) = 1.424$, $p = 0.242$, partial $\eta^2 = 0.007$. There was also no statistically significant interaction effect on QES between the percent product completion and time on QES, $F(2, 421) = 1.565$, $p = 0.210$, partial $\eta^2 = 0.007$.

Figure 19

Estimated Marginal Means of QES by Product Completion and Time



Note. N= 424 for those with pre and post assessment data. QES denotes Q-Life Experience Score, and it is a percent score. Error bars denote 95% confidence intervals. All three completion groups showed that Time Two QES was significantly higher than Time One QES, with a difference of 9.6%. There were no significant main or interaction effects for percent program completion. The sample for the 0% completion group, 1-32% completion group, and ≥33% completion group were 33, 151, and 240 respectively.

Logged Lifestyle Behaviours and Mentalities

A hierarchical multiple regression was run to determine if the addition of logged lifestyle behaviours and then logged mentalities improved the prediction of T2 QES above T1 QES alone. The number of pairwise cases (n) analysed in the multiple regression was 360 as 64 of the 424 participants with T1 and T2 QES did not also have logging data.

There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.059. There was incomplete homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. The only partial regression plot to show a clear linear relationship was that between T1 and T2 QES. The other partial regression plots and the studentized residuals versus unstandardized predicted values plot did not show a clear linear relationship which suggests a violation of the assumption of homoscedasticity. Logging count 'yes' to sleep, and all mentality items showed evidence of multicollinearity (a violation of the test assumptions), as assessed by tolerance values less than 0.1. Two outliers were found where standardized residuals were ±3SD. Only one outlier showed when looking for studentized deleted residuals ±3. Eight leverage values were found above 0.2. There were no values for Cook's Distance above 1. The assumption of normality was, however, met, as assessed by a histogram and P-P plot of the regression standardized residual dependent variable and a Q-Q Plot of the studentized residuals.

The lack of a linear relationship between T2 QES and logging variables, the heterogeneity of residuals (heteroscedasticity), and the evidence of multicollinearity are all significant violations to regression analysis. Future analyses could try dropping the offending variables with tolerances values below 0.1 and re-trying for hierarchical multiple regression analysis. Given the number of logging variables that would have to be removed to avoid violating the test assumptions, investigating a weighted least-squares regression may be more appropriate. For curiosity's sake and for project timeline restrictions, the analysis was continued but it is important to note these major statistical power limitations.

Model 1, with only the baseline score, accounted for much of the variance (33%) in T2 QES and was a statistically significant model, $R^2 = 0.326$, $F(1,358) = 174.909$. $p = 8.6761E\text{-}33$. The addition of logged lifestyle behaviours led to a statistically significant increase in the amount of variance explained ($\Delta R^2 = 0.021$, $p = 0.022$) for an α-value of 0.05. With reduced statistical power, however, an α-value of 0.001 is more appropriate and by that parameter, the 2.1% increase in variance explained by model 2 is not statistically significant. Model two itself was statistically significant $R^2 = 0.350$ $F(4, 354) = 2.911$. $p = 3.2136E\text{-}31$. The full model of baseline score logged lifestyle behaviours, and logged mentalities to predict T2 QES (Model 3) was statistically significant, $R^2 = 0.354$, adjusted $R^2 = 0.333$, $F(11,348) = 17.319$, $p = 2.4603E\text{-}27$; though model 3 did not account for a statistically significant increase in variance explained ($\Delta R^2 = 0.004$, $p = 0.895$).

Only the variable of count of log yes to nutrition was found to be significant such that per one unit increase in nutrition, T2 QES increased by 0.22 ($0.001<p<0.05$ for models 2 and 3). Table 4 summarizes the results of the hierarchical multiple regression. Further details as to statistical results for the hierarchical multiple regression can be found in Appendix F.

Table 3

Hierarchical Multiple Regression Predicting Time Two QES from Time One QES and Logging Variables

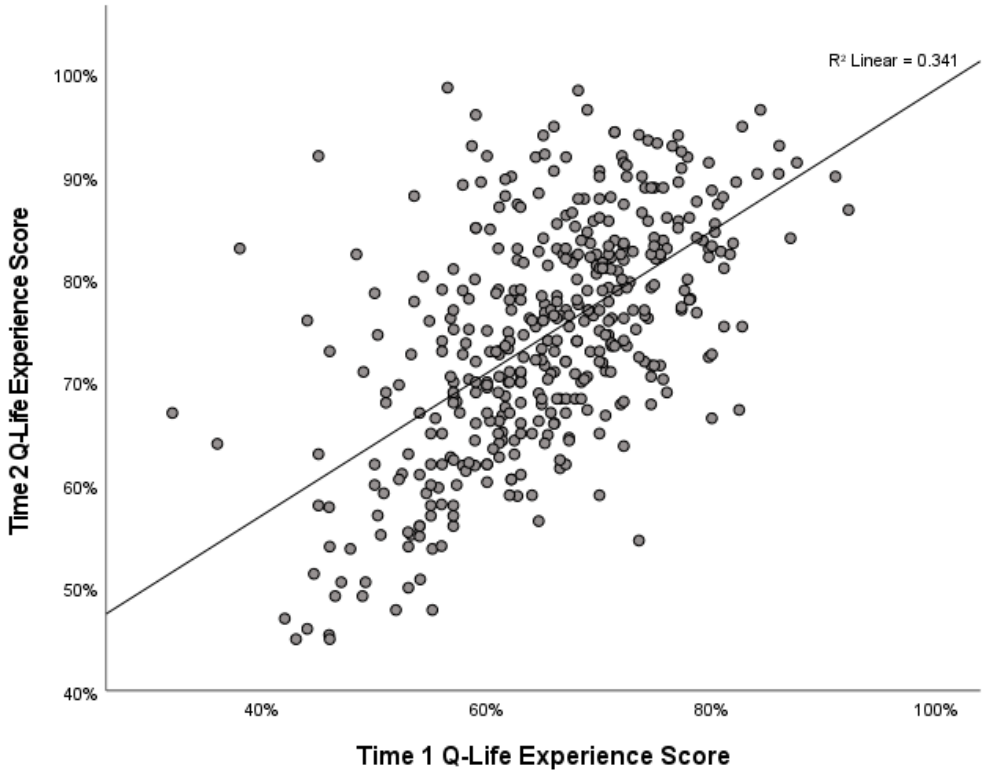
	Time Two QES					
	Model 1		Model 2		Model 3	
Variable	B	β	B	β	B	β
Constant	.310**		.317**		.325**	
Time One QES	.673**	.573	.655**	.557	.643**	.547
CLY Physically Active			-.001	-.059	-.001	-.072
CLY Nutrition			.003*	.222	.003*	.216
CLY Adequate Sleep			-.002	-.171	-.004	-.348
CLY Hydration			.002	.126	.001	.081
CLY Having Energy					.002	.127
CLY Excited to Start Day					-.001	-.063
CLY Feeling in Charge of Day					.000	-.022
CLY Feeling Pumped					.002	.168
CLY Living by Values					-.002	-.156
CLY Living by Vision					.002	.191
R^2	.328		.350		.354	
F	174.909**		38.058**		17.319**	
ΔR^2	.328		.021		.004	
ΔF	174.909**		2.911*		.374	

Note. N = 360 (from 424 with pre and post, data excluded pairwise where missing logging data). * $p < 0.05$, ** $p < 0.001$. QES stands for Q-Life Experience Score. CLY stands for Count of Logged 'yes' i.e., the number of times someone responded in the affirmative as having done the behaviour or experienced the mentality of that logging item. The significance of R^2 is indicated in this table by F-value significance. The significance of change in R^2 (ΔR^2) is indicated by significance of ΔF.

There was a clear relationship between T1 and Time Two QES, as depicted in figure 20.

Figure 20

Scatterplot of Time One Versus Time Two Q-Life Experience Score



The lack of a linear relationship between Time Two QES and any of the logged lifestyle behaviours and mentalities (Appendix F) indicated against analysing the role of logged lifestyle behaviours and mentalities by Q-Life version or by COVID-19 impact in predicting outcomes and so this analysis was not explored further.

Research Question Three: Q-Life Subgroup Differences in Effectiveness and Reach

Q-Life Effectiveness Across Q-Life Versions

There were 226, 127, and 71 participants with T1 and T2 QES across Q-Life versions 1, 2, and 3, respectively. Cohen's *d* was calculated, and results showed strong effect sizes of 0.89 for V1 Q-Life, 0.92 for V2 Q-Life, and 1.06 for V3 Q-Life.

Table 4

Comparing QES from Time One to Time Two by Q-Life Program Version

		Time One QES	Time Two QES
Q-Life Version 1	n	226	226
	Mean (±SD)	66% (±8.6%)	75% (±11%)
	Median (IQR)	66% (11%)	76% (16%)
	Minimum	46%	46%
	Maximum	92%	98%
Q-Life Version 2	n	127	127
	Mean (±SD)	62% (±10%)	71% (±11%)
	Median (IQR)	62% (12%)	71% (15%)
	Minimum	32%	45%
	Maximum	91%	96%
Q-Life Version 3	n	71	71
	Mean (±SD)	69% (±8.4%)	78% (±9.0%)
	Median (IQR)	68% (12%)	79% (12%)
	Minimum	45%	51%
	Maximum	88%	99%)

Note. Total N = 1076 with Time One assessment data and n = 424 with Time One and Time Two assessment data. QES stands for Q-Life experience Score, and it is a percent score. SD denotes Standard Deviation. IQR denotes interquartile range.

Results of the two-way mixed factorial ANOVA revealed that there was a statistically significant difference in mean QES between distinct groups F(2, 421) = 15.533, p = 3.1009E-7, partial $\eta^2 = 0.67$. V1 Q-Life had a mean QES score 4.1%, 95% CI [0.018, 0.065] higher than V2, a statistically significant difference, p = 0.099E-3. V3 had a mean QES score 6.9%, 95% CI [0.037, 0.100] higher than V2, a statistically significant difference, *p* = 8.05E-7. While not significant, V3 had a mean QES score 2.7%, 95% CI [-0.002, 0.056] higher than V1, *p* = 0.070. T1 to T2 changes in QES were similar across the three program iterations (previously shown in figure 17). There was no significant interaction effect between time and Q-Life program version on QES, $F(2, 421) = 0.361$, $p = 0.697$, partial $\eta^2 = 0.002$. Details of the analysis results can be found in Appendix D. Where there was no statistically significant interaction effect between time and Q-Life version on QES, participants could be regrouped by COVID-19 impact.

Q-Life Effectiveness Across COVID-19

There were 185 participants with pre- and post-assessments completed before COVID-19 (before March 2020) and 239 who completed after COVID-19 shutdowns in Nova Scotia (March 2020 an onward). Cohen's *d* was calculated from T1 to T2 QES and results showed significant large effect sizes of 0.78 for 'Pre-COVID Impact' and 0.86 for 'COVID-19 Impacted'.

Table 5

Comparing QES from Time One to Time Two by COVID-Impact

		Time One QES	Time Two QES
Pre-COVID-19 Impact	n	185	185
	Mean (±SD)	66% (±8.6%)	74% (±12%)
	Median (IQR)	66% (12%)	75% (16%)
	Minimum	46%	45%
	Maximum	84%	98%
COVID-19 Impacted	n	239	239
	Mean (±SD)	65% (±10%)	74% (±11%)
	Median (IQR)	54% (12%)	75% (16%)
	Minimum	32%	45%
	Maximum	92%	99%

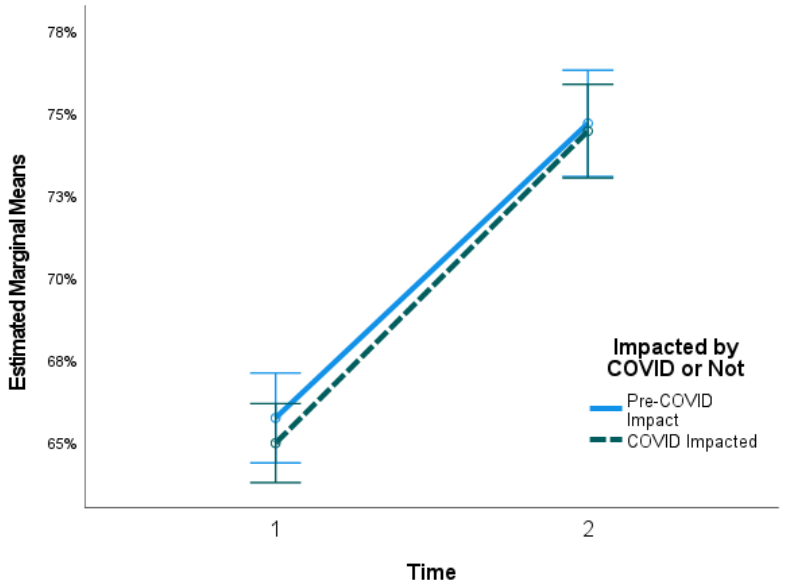
Note. Total n = 424 with Time One and Time Two assessment data. QES stands for Q-Life experience Score, and it is a percent score. SD denotes Standard Deviation. IQR denotes interquartile range.

Shapiro-wilk test indicated that all but T2 QES in the 'Pre-COVID Impact' group was normally distributed ($p > 0.05$). That said, the boxplot for T1 QES in the 'COVID Impacted' group revealed five outliers. There were two outliers, as assessed by examination of studentized residuals for values greater than ±3. Examination of Q-Q plot of studentized residuals revealed mostly normal distribution for T1 and T2 QES. Levene's test of equality of error variances revealed homogeneity of variances for T1 and T2 QES ($p > 0.05$). There was homogeneity of covariances, as indicated by Box's test of equality of covariance matrices ($p = 0.023 > 0.001$). After evaluating these assumptions, a two-way mixed factorial ANOVA was completed.

The ANOVA revealed a statistically significant main effect in QES at different time points, F(1, 422) = 389.53, p = 6.6732E-62, partial η^2 = 0.481. T2 QES was significantly higher than T1 QES, with a difference of 9.2% (p = 6.6732E-62). There was no significant difference in mean QES between COVID-19 impact groups, F (1, 422) = 0.309, p = 0.578, partial η^2 = 0.001. There was no statistically significant interaction effect between time and COVID-19 Impact, F(1, 422) = 0.321, p = 0.571, partial η^2 = 0.001. Q-Life maintained similar effectiveness in both pre-COVID and COVID-impacted groups (figure 21). Details of the ANOVA analysis results can be found in Appendix G.

Figure 21

Estimated Marginal Means of QES by COVID-19 Impact and Time



Note. Error bars denote 95% confidence intervals. Both 'Pre-COVID-19 Impact' and 'COVID-19 Impacted' groups showed that Time Two QES was significantly higher than Time One QES, with a difference of 9.2% (p = 6.6732E-62). There were no significant main effects by COVID impact or interaction effects. Sample (n) sizes for the 'pre-COVID-19' group and 'COVID-19 Impacted' group were 185 and 239 respectively.

Participant Demographics

In Q-Life V1, most participants were 18 years old (28%) with 19 and 25+ being the second and third most common categorical ages in years (18% and 17%

respectively). In Q-Life V2, most participants were 19 years old (27%) with 18 and 20 being second and third most common ages in years (18% and 16% respectively). It is worth nothing that for V2, many participants were 21 years old as well (12%). In Q-Life V3, most participants were 18 years old (58%), with 17 and 19 being the second and third most common ages in years (17% and 7% respectively). It is worth noting that for V3, the age category of 25+ was close to the third most common age, making up 7% of the sample.

In Q-Life V1, 489 participants (78%) identified as female and 128 (20%) as male. Within Q-Life V1, 200 of the 489 participants identifying as female completed both pre and post assessment. Of the 128 V1 Q-Life participants identifying as male, 70 completed both pre and post assessments. In V2, 220 (79%) females and 56 (20%) males. For V2, 57 females and 20 males completed pre and post assessments. In V3, 103 (61%) females and 60 (36%) males. For V3, 45 females and 25 males completed both pre and post assessments. The remaining percentages of participants for each version either selected 'other', 'unspecified', or simply 'prefer not to answer' (across all three program versions, n=11, n=2, and n=7 respectively). Virtually none who identified as a gender other than male, or female were reached.

In Q-Life V1, 199 (32%) identified as a racialized person while 409 participants (65%) identified as white/non-racialized. Of the 199 V1 Q-Life participants identifying as a racialized person, 91 participated in pre and post assessments. Of the 409 non-racialized V1 participants, 174 completed pre and post assessments.

In Q-Life V2, 41 (15%) identified as a racialized person and 235 (84%) identified as Caucasian/non-racialized. Within the 41 who identified as a racialized person, 16 had both pre and post assessment. Within the 235 who identified as Caucasian/non-racialized, 60 both pre and post assessments.

In Q-Life V3, 34 (20%) identified as a racialized person and 130 (77%) identified as Caucasian/non-racialized. Of the 35 racialized individuals, 15 identifying had pre and post assessment data. Of the 130 Caucasian/non-racialized individuals, 56 completed

pre and post assessments. The remaining percentages for each Q-Life version were made of participants who chose not to identify their race.

Table 1 below displays demographics by Q-Life program version. Participants who selected 'other' or 'prefer not to identify' as gender and participants who selected 'prefer not to identify' for racial identity are not included in Table 1 because these group were small and risked being identifiable when split across program version. There were respondents for each of these categories.

Table 6

Demographic Data by Q-Life Program Version.

	Q-Life Version 1	Q-Life Version 2	Q-life Version 3
N	628	280	168
Age in years			
Mean ± SD	20 (±2.5)	21 (±2.5)	19 (±2.0)
Median (IQR)	19 (4)	20 (3)	18 (0)
Gender			
Female	489 (78%)	220 (79%)	103 (61%)
Male	128 (20%)	56 (20%)	60 (36%)
Racial identity			
Racialized/Non-Caucasian	199 (32%)	41 (15%)	34 (20%)
Non-racialized/Caucasian	409 (65%)	235 (84%)	130 (77%)

Note. SD denotes Standard Deviation. IQR denotes Interquartile Range. Age data was collected as ordinal data where the highest category response option was age '≥25 years.' For this table, age was converted to continuous data and that highest category response was converted to '25 years.', There were some participants who identified as '≥25 years' in each program version (n=105 in Q-Life V1; n=24 in V2; and n=11 in V3). It is worth noting that for V3, the age category of ≥25 was close to the third most common age, making up 7% of the sample. Participants in this table were included regardless of whether they had pre and post assessment data (n=1076).

Subgroup Differences in Engagement

Engagement levels were generally high across all participants (N=1076); many participants completed over 80% of the program (n=499, 46%) across all three Q-Life versions. A summary of central tendencies of the engagement data can be found in

table 4. Figures 22, 23, and 24 display the boxplots for engagement variables across the Q-Life versions.

Table 7

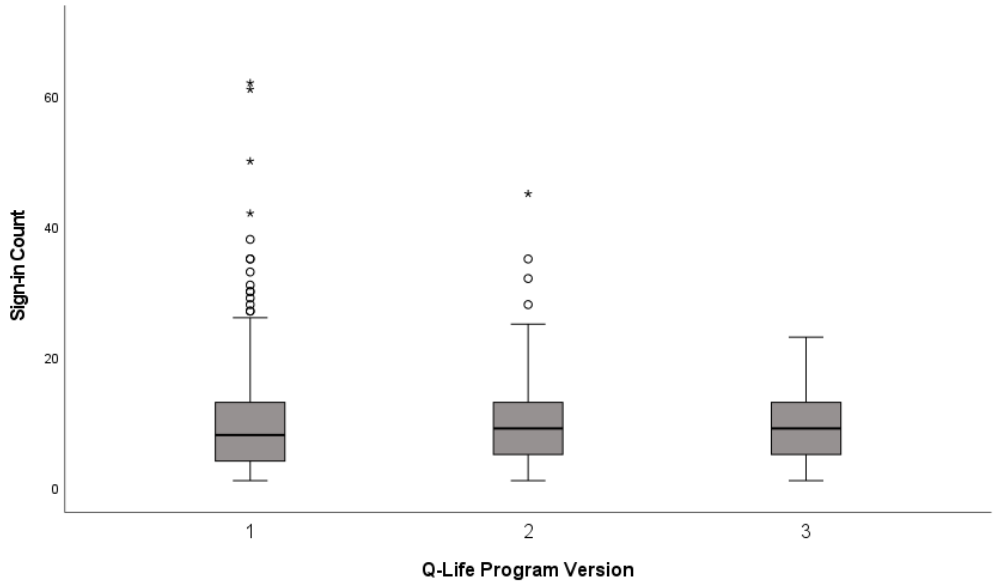
Participant Engagement Across Q-Life Program Versions

	Just Pre-Assessment			Pre and Post Assessment		
	Q-Life Version			Q-Life Version		
	1	**2**	**3**	**1**	**2**	**3**
Sign-in count (a.k.a. login)	N= 352	N= 202	N= 97	N= 275	N= 78	N= 71
Mean (±SD)	7.08 (±6.78)	6.80 (±6.35)	9.5 (±5.54)	7.86 (±8.3)	6.58 (±5.93)	8.28 (±5.12)
Std. Error of Mean	0.36	0.45	0.56	0.5	0.67	0.61
Median	5.00	5.00	10.0	5.0	4.0	8.0
Min-Max	1-50	1-45	1-23	1-62	1-32	1-22
Logging entry count	N=205	N= 96	N= 88	N= 182	N= 47	N= 59
Mean (±SD)	5.99 (±7.53)	4.77 (±6.26)	6.6 (±7.35)	6.63 (±11.84)	5.2 (±6.2)	6.98 (±6.8)
Std. Error of Mean	0.53	0.64	0.783	0.88	0.90	0.88
Median	3.0	2.0	3.5	2.0	3.0	5.0
Min-Max	1-36	1-42	1-33	1-88	1-26	1-28
Percent Program Completion	N= 353	N= 202	N=97	N= 275	N= 78	N= 71
Mean (±SD)	45.58 (±43.3)	49.58 (±42.48)	84.23 (±28.62)	51.9 (±41.5)	43.9 (±40.0)	79.3 (±31.5)
Std. Error of Mean	2.31	2.98	2.91	2.51	4.5	3.7
Median	21	43	96	45.0	28.0	94.0
Min-Max	0-100	0-100	0-100	0-100	0-100	0-100

Note. N denotes participants with data (cases excluded pairwise). SD denotes Standard Deviation. IQR denotes Interquartile Range. Min-Max denotes the lowest and highest datum respectively. A.k.a. denotes 'also known as.' Percent Program Completion includes the completion of Q-Life videos; it does not include completion of the companion workbook or how many times a video was viewed. Data were drawn from N = 1,076 which includes those with only pre assessment data (n= 652) and those who have both pre and post (n=424) because these analyses are meant to investigate reach and engagement, which is separate from time effect on QES and the Q-Life assessment.

Figure 22

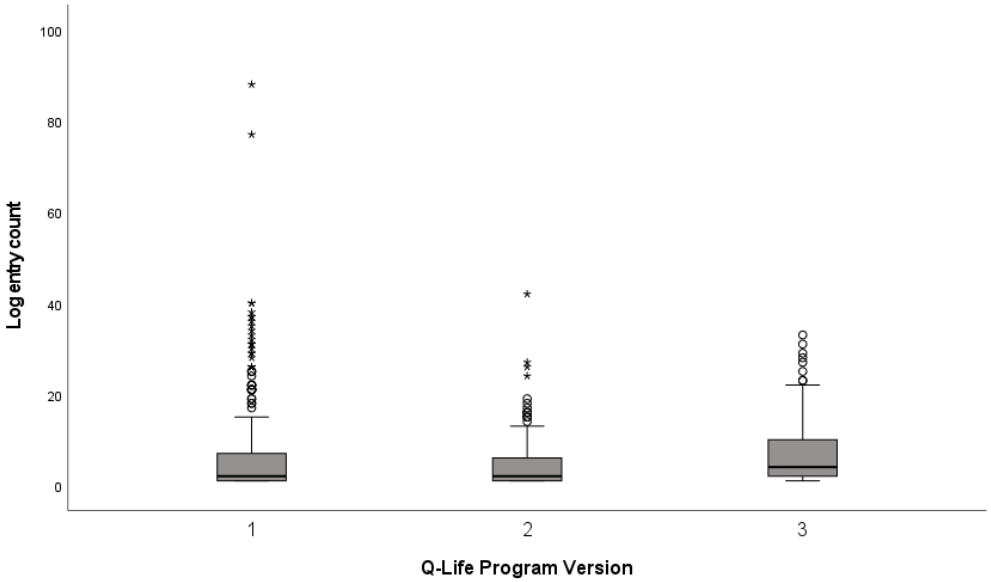
Boxplot of Sign-in Count by Q-Life Version



Note. Data were drawn from N = 1,076 which includes those with only pre assessment data (n= 652) and those who have both pre and post (n=424). In this boxplot, n= 387, 143, and 147 for those with sign-in count data within Q-Life version 1, 2, and 3 respectively. Circles denote outliers (1.5 times the interquartile range) while asterisks denote extreme outliers (3 times the interquartile range).

Figure 23

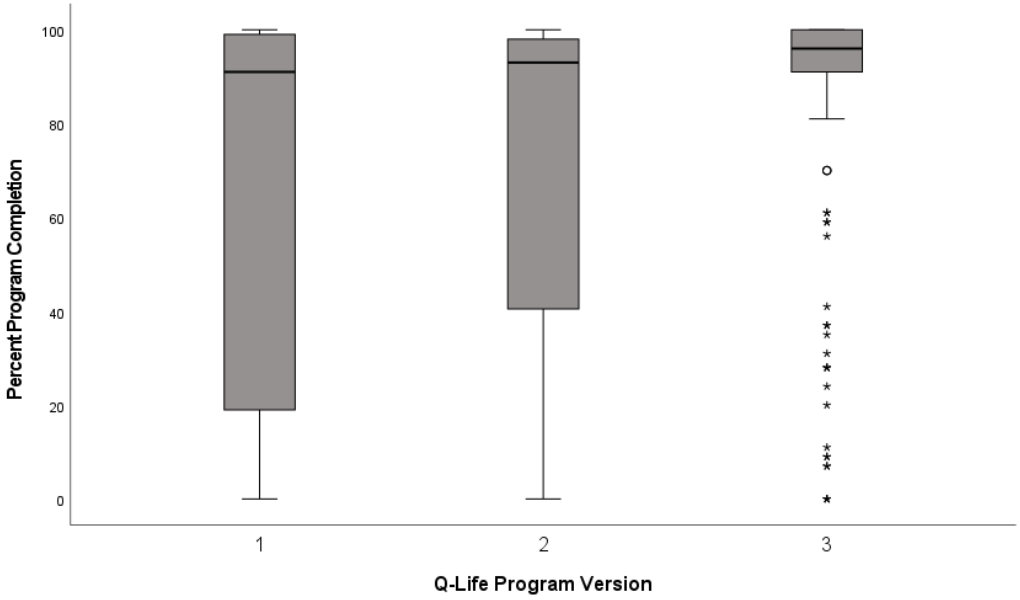
Boxplot of Particiant Logging Entry Count by Q-Life Version



Note. Data were drawn from N = 1,076 which includes those with only pre assessment data (n= 652) and those who have both pre and post (n=424). In this boxplot, n= 387, 143, and 147 for those with log entry count data within Q-Life version 1, 2, and 3 respectively. Circles denote outliers (1.5 times the interquartile range) while asterisks denote extreme outliers (3 times the interquartile range).

Figure 24

Boxplot of Participant Program Completion By Q-Life Version



Note. Data were drawn from N = 1,076 which includes those with only pre assessment data (n= 652) and those who have both pre and post (n=424). In this boxplot, n= 387, 143, and 147 for those with percent program completion data within Q-Life version 1, 2, and 3 respectively. Circles denote outliers (1.5 times the interquartile range) while asterisks denote extreme outliers (3 times the interquartile range).

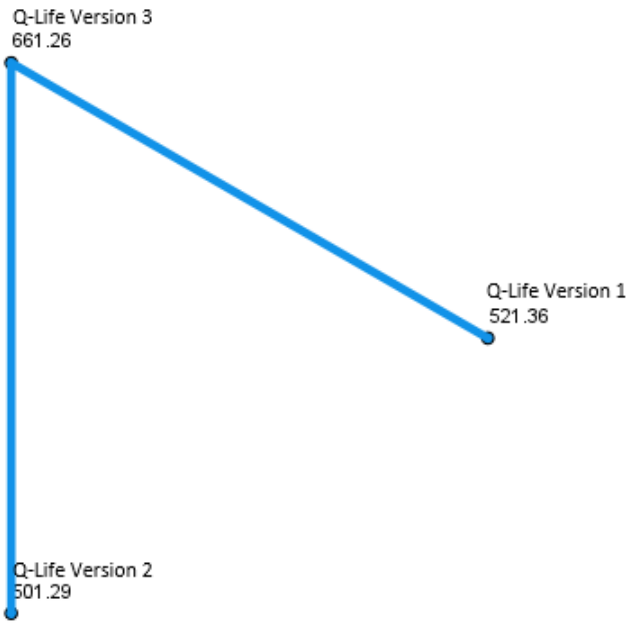
For sign-in count and log entry count, the distribution of data is similar for all groups, as assessed by visual inspection of boxplots. For these elements of engagement, a comparison of medians via Kruskal Wallis H test (a.k.a. One-way ANOVA on ranks) was done across Q-Life versions.

Sign-in count median scores for V1 (n=627), V2 (n=280), and V3 (n=168) were statistically significantly different between groups, $\chi^2(2) = 32.425$, p = 9.10E-8. Pairwise comparisons were performed using Dunn (1964) procedure with Bonferonni correction for multiple comparisons. This post-hoc analysis revealed statistically significant differences in sign-in count between Q-Life V2 (Mdn = 5.00) and V3 (Mdn = 8.00) (Adjusted *p* = 3.50E-7) and V1 (Mdn = 5.00) and V3 (Mdn = 8.00) (Adjusted *p* = 5.8103E-7) groups, but not between the V2 and V1 groups (*p* = 0.367, adjusted *p* = 1.00). Figure

25 depicts the pairwise comparisons of Q-Life versions for sign-in count. Figure 25 shows the pairwise comparisons for Q-Life version for sign-in count.

Figure 25

Pairwise Comparison of Q-Life Version for Sign-in Count



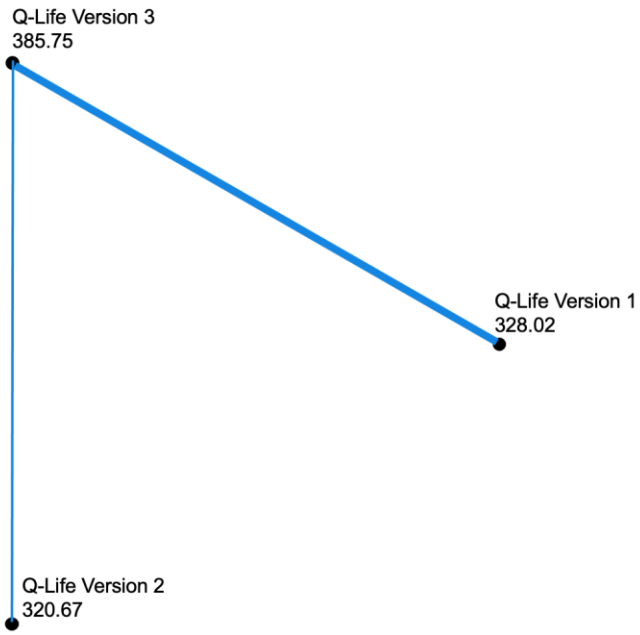
Note. N = 1075 for those with sign-in count data across all three Q-Life program versions. For Q-Life versions 1, 2, and 3, n= 627, 280, and 168 respectively. Each node represents a different Q-Life version and its median rank. The median rank is calculated by ordering the entire sample of observations, regardless of group, by the size of their values. The person/observation with the smallest value gets the rank of 1, and so on. Then, the median rank for each group is computed compared. The joining lines indicating a pairwise comparison in which the asymptotic *p*-value was significant ($p < 0.05$) both before *and* after Bonferonni correction.

Log entry count median scores for V1 (n=387), V2 (n=143), and V3 (n=147) were significantly different between groups, $\chi^2(2) = 11.376$, p = 3.39E-3. Pairwise comparisons were performed using Dunn (1964) procedure with Bonferonni correction for multiple comparisons. This post-hoc analysis revealed statistically significant differences in log entry count between Q-Life V2 (Mdn = 2.00) and V3 (Mdn = 4.00) (adjusted p =0.11) and V1 (Mdn = 2.00) and V3 (Mdn = 4.00) (adjusted p = .005) groups, but not between the

V2 and V1 groups (p = 0.695, adjusted p = 1.00). Figure 26 shows the pairwise comparisons of Q-Life versions for log entry count.

Figure 26

Pairwise Comparisons of Q-Life Versions for Log Entry Count



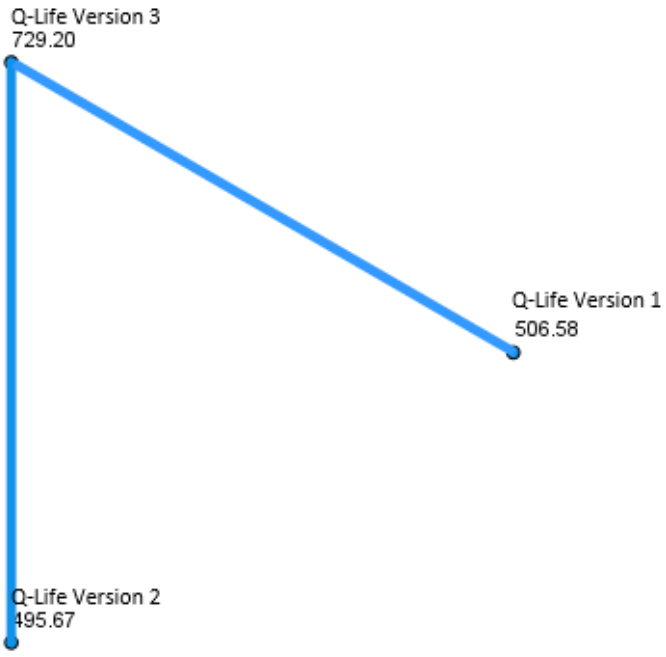
Note. N = 677 for those with log entry data across all three program versions. For Q-Life versions 1, 2, and 3, n= 387, 143, and 147 respectively. Each node represents a different Q-Life version and its median rank. The median rank is calculated by ordering the entire sample of observations, regardless of group, by the size of their values. The person/observation with the smallest value gets the rank of 1, and so on. Then, the median rank for each group is computed compared. The thin joining line indicates a pairwise comparison where the asymptotic p-value was significant ($p < 0.05$) but adjusted p-value was not significant after Bonferroni correction. The bolded joining line indicates a pairwise comparison that is statistically significant for asymptotic p values and adjusted p values after Bonferroni correction (p and adjusted $p < 0.05$).

For percent program completion, distribution of scores was not similar for all groups, as assessed by visual inspection of a boxplot. For this element of engagement, a comparison of distributions was done, and mean rank was reported on rather than medians. The distributions of percent program completion scores for V1 (n=628), V2 (n=280), and V3 (n=168) were significantly different between groups, $\chi2(2) = 75.613$, p <

0.005. Pairwise comparisons were performed using Dunn (1964) procedure with Bonferonni correction for multiple comparisons. This post-hoc analysis revealed statistically significant differences in percent product completion scores between Q-Life V3 (mean rank = 729.20) and V1 (mean rank = 506.58) (p = 3.46E-14) and between V2 (mean rank =495.67) and V3 (p = 0.0E0), but not between V2 and V1 (*p* = 0.624, adjusted *p* = 1.00). Figure 27 shows the pairwise comparison of Q-Life versions for percent program completion. Details of the statistical analysis results can be found in Appendix H.

Figure 27

Pairwise Comparison of Q-Life Versions for Program Completion



Note. N = 1076 for those with percent program completion data across all thre Q-Life program versions. For Q-Life versions 1, 2, and 3, n= 628, 280, and 168 respectively. Each node represents a different Q-Life version and its average rank. The average or mean rank is calculated by ordering the entire sample of observations, regardless of group, by the size of their values. The person/observation with the smallest value gets the rank of 1, and so on. Then, the average rank for each group is computed compared. The joining lines indicating a pairwise comparison in which the asymptotic *p*-value was significant ($p < 0.05$) both before *and* after Bonferonni correction.

Engagement by Gender and Q-Life Version.

Response options were collapsed post hoc due to uneven sample sizes. Post hoc groups included 'female,' 'male,' and 'other.' From V1 and V3 assessments, those who selected 'unspecified' or 'other' were combined into one group as there was only a couple of affirmative responses to the 'other' and 'unspecified' response options across both versions.

As assessed by scatterplots (Appendix I), there was reduced power to predict differences because there were no linear relationships between the dependent and independent variables of gender, Q-Life version, and engagement (sign-in count, logging entry count, and percent product completion). There was evidence of multicollinearity across one combination of independent variables (log entry count and percent product completion, $|r| = 0.919$), as assessed by Pearson correlation ($|r| < 0.9$). Usually, the offending dependant variable would be removed but neither of these variables are offending in other combinations. There were many univariate outliers across multiple combinations of groups, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box (Appendix I). None were data entry errors or measurement errors, so they were noted and kept. There were three dependent variables making the critical Mahalanobis' distance value to be 16.27. By this standard, there were nine multivariate outliers ($p > .001$). These genuinely unusual values were noted and kept in the analysis. Engagement factors were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). There was heterogeneity of covariance matrices, as assessed by Box's M test ($p = 1.50E-17$). Box's M test is extremely sensitive, and a false violation can be attributed to non-normality. The MANOVA is robust to the violation of homogeneity of covariance matrices as long the sample size in each cell/subgroup of the design is similar. There were inadequate sample sizes for analysing those who identified with a gender 'other' (than male or female). Due to unequal sample sizes and heterogeneity of covariance matrices, Pillai's Trace was reported on instead of Wilk's Lambda.

There was no significant interaction effect between gender and Q-Life Version on the combined engagement variables, $F(12, 2001) = 0.455$, $p = 0.941$, Pillai's Trace = 0.008, partial $\eta^2 = 0.003$. The main effects for Q-Life Version on the combined engagement variables was not statistically significant, $F(6, 1332) = 0.618$, $p = 0.718$, Pillai's Trace = 0.006, partial $\eta^2 = 0.003$. Nor were the main effects of gender on the combined engagement variables statistically significant, $F(9, 2001) = 1.44$, $p = 0.167$, Pillai's Trace = 0.019, partial $\eta^2 = 0.006$. Details of the results from the statistical analyses can be found in Appendix I.

Engagement by Racial Identity and Q-Life Version.

There was no linear relationship between the dependent variables, as assessed by scatterplot. This violation and the subsequent reduction in power is noted. There was no evidence of multicollinearity, as assessed by Pearson correlation ($|r| < 0.9$). There were many univariate outliers in the data across the subgroups, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. These genuinely unusual values were noted, and the analysis resumed. With a critical Mahalanobis' distance of 16.27, there were 12 multivariate outliers ($p > .001$) noted. These outliers were included in analysis because the researcher believed the result would not be substantially affected given the lack of variability in the sample. Engagement factors were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$) across all groups except the extremely small subgroups of those who preferred not to identify as their racialization. The two-way MANOVA is relatively robust to deviations from normality regarding Type 1 error, so the genuinely unusual values were kept, and the analysis continued. The assumption of homogeneity of covariance matrices was violated, as assessed by Box's M test ($p = 2.31E-20$). Levene's test of Homogeneity of Variance ($p > .05$) revealed a heterogeneity of variance. Uneven cell/sub-group sizes and heterogeneity of variance mean Pillai's Trace was used and α-level was lowered to 0.001.

There was no significant main effect of Q-Life Version on the combined engagement variables, $F(6, 1334) = 2.078$, $p = .053$, Pillai's Trace = .019, partial $\eta^2 = .009$.

The main effect of racial identity on the combined engagement variables was not statistically significant, $F(6, 1334) = .590$, $p = .738$, Pillai's Trace = .005, partial $\eta^2 = .003$. The interaction effect between racial identity and Q-Life Version on the combined engagement variables was not statistically significant, $F(12, 2004) = .396$, $p = .966$, Pillai's Trace = .007, partial $\eta^2 = .002$. Details of the results from the statistical analyses can be found in Appendix J.

Chapter 5: Discussion

The present study set out to evaluate the online well-being and resilience program for post-secondary students called Q-Life to make data-driven recommendations for program development. Evaluation included the quantifying the effectiveness of the program at improving QES (a measure of well-being and resilience). As well, this study also sought to determine whether there was a relationship between elements of Q-Life participation to the well-being and resilience-based outcome of QES. Finally, this study sought to investigate differences in effectiveness across subgroups by program version and by COVID-19 pandemic impact, and in reach by demographics. Overall, the Q-Life program was effective at improving measures of well-being and resilience 8-10%, as indicated by the Q-Life assessment (the QES and the QES Common). The primary predictor of improvement in QES score was baseline score, meaning that logging, engagement, or demographic factors did not significantly influence the responses to the Q-life program. Improvement in QES was consistent across program versions and COVID-19 impact and was independent of program engagement. Program engagement did vary slightly by program version, likely because of implementation at different institutions with difference incentives outlined for different disseminations of the program; however, the primary users of Q-Life were white females and revisions and developments in the Q-Life program from V1 to V3 did not significantly affect the reach of the program with various demographics in the mode of distribution that was evaluated in this research analysis.

Research Question One: Q-Life Effectiveness

As hypothesized, Q-Life appears to consistently and effectively increase factors related to resilience and well-being in post-secondary students. The average improvement in QES score across the different versions was 9.7%.

The Q-Life assessment measures behaviours and mentalities related to resilience and mental health. Our finding of a near 10% improvement in related factors for a resilience and well-being program is consistent with other mental health interventions with overlapping content. College students with elevated levels of anxiety at baseline

who participated in an online cognitive-behavioural skill-building intervention showed significant decline in symptoms (Melnyk et al., 2015). These findings are consistent as well with an online resilience program consisting of video and text training modules (Smith et al., 2018). While the Smith et al studied a significantly older population, the intervention group experienced positive effects on resilience, stress, and symptoms of stress (Smith et al., 2018). The present study is markedly divergent in results as no dose-effect could be established, where Smith and team (2018) found that positive effects were proportionate to minutes of program participation. Although the assessment tool developed and used with the Q-life program was designed to be specific to the curriculum, include multiple domains and be as efficient as possible, future research and evaluations of Q-Life may consider validated assessment for related constructs for greater comparability with other literature. These findings underscore that e-mental health programs using program-specific assessments utilize validated measures of constructs both negatively and positively related to the program target construct to ensure discriminant and convergent validity, respectively. For Q-Life specifically, the QES results could be assessed alongside other validated quality of life measures, mental health literacy measures, stress measures, and grade point average. There are plans for the Post-secondary Student Stress Index (PSSI) and the Behavioural Health Measure 20 (BHM-20) to be implemented alongside the Q-Life assessment. It is encouraged that future research cross-compare results of these measures in the evaluation of Q-Life. Alternative assessments that may be useful to implement separately from but alongside the Q-Life assessment is the Short-form Warwick-Edinburgh Mental Well-being Scale (WEMWBS-7) (Clarke et al., 2011).

Q-Life Experience Score Common Items

QES across time and program version showed significant main effects of time and program version. Meanwhile, QES Common showed no significant interaction effects or main effect of program version and showed a significant main effect of time. Where both had significant main effects for time and insignificant interaction effects, this implies that even though assessments VA and VB were different overall, indeed, the

elements captured by the QES Common were likely, as hypothesised, principal elements of well-being and resilience as measured by Q-Life. The items across VA and VB assessments that were common were those perceived by Q-Life developers to be the most important. The results suggest appropriate selection of the common items and retention of construct evaluation across both assessment versions. Where QES showed a significant main effect by program version and QES Common did not, this means that the non-common 43 to 44 items of the QES may have been capturing variation in program implementation. Q-Life V1 and V3 were significantly different than V2. The Q-Life version main effects realized in the earlier analyses may be due to assessment effects or due to the characteristics of students across the schools which the Q-Life versions were launched. The VA assessment (with 43 non-common QES items) was implemented primarily at Dalhousie University for Q-Life program versions V1 and V3. The VB assessment (with 44 non-common QES items) was implemented at Acadia University in program V2.

Research Question Two: Influencers of Q-Life Effectiveness

Participant Engagement

Engagement was generally high across all three Q-Life versions, although there were marked differences in engagement across all three Q-Life versions (V1 data from Dalhousie University and pilot intervention, V2 from Acadia University, and V3 from one Dalhousie University class). This high engagement may substantiate Q-Life's accessibility, but it is also important to recognize that all three versions analyzed in this study had incentives for participation. There were significant differences between V2 and V3 Q-Life and between V1 and V3 Q-Life for sign-in count, log entry count, and percent program completion but not between V1 and V2. This suggests that V3 is particularly different from the other two Q-Life versions. The difference is most likely due to the notably higher incentivization that occurred for those who participated in V3 (because it was embedded into the mark structure of a university course) as compared to V1 and 2, which had similar incentivization strategies that were tied to gaining bonus marks in university courses.

Q-Life thus far has been implemented in activated populations given the incentivization for program completion. In versions 1 and 2 of Q-Life, participants received 1% bonus marks for participating in the pre and post assessment or 3% bonus marks for participating in over 80% of the program content. For Q-Life V3 participants, 10% of a course grade came from their participating in both assessments plus ≥80% of the program. Stigma around mental health can often alter students' attitudes around seeking support and, subsequently, their intentions to seek support (Hilliard et al., 2022). So, while incentivization is not ideal for assessing the natural reach of the program, contact and education are important for reducing stigma and providing services that may support populations resistant to seeking support (Hilliard et al., 2022). That said, it would be beneficial to investigate reach and retention without incentivization to compare to the incentivized groups. Future evaluation of Q-Life should evaluate Q-Life in an unincentivized model. Should reach and engagement drop, this would prompt investigation of why and exploration of alternative incentives that still attract students to mitigate stigma of using mental health resources, but that does not artificially inflate engagement and retention reports.

While there was minimal variance in percent program completion and only a small group of zero percent completers, it would be remiss not to acknowledge that those who did not engage with any of the video content showed similar differences in QES from T1 to T2 as those who did engage. Because there was no significant effect on QES caused by an interaction between time and percent program completion, it is unlikely that the explanation for the lack of differences in change is due to the low engagement groups having more "room" to improve their QES. Such results indicate that there could be a testing effect rather than a learning effect to change in QES. I.e., participants' changes in QES may be due to familiarity with the assessment rather than true improvements to the tested concepts. Other possible explanations for the non-significant effect of percent product completion on QES could be that (a) percent product completion does not account for engagement with the digital companion workbook file, (b) the percent product completion does not account for how many

times someone revisited the video content they once engaged in, or (c) the uneven group sizes (almost half of participants engaged in >80% of the program). Option (c) is probable given the lack of statistical power for the test caused by extremely unbalanced subgroups. Regardless, it is crucial for e-mental health programs to design their engagement data collection methods with the end in mind. Greater granularity and holisticness of engagement with online e-mental health programs across the entire program can improve developers' understanding of user experiences with the various elements of the program and can shine light on roadblocks that need to be addressed to better the serve the target population. For Q-Life particularly, engagement data worth collecting related to engagement would be interaction with the companion workbook, number of revisits to specific content, or time spent interacting with content, time stamp of when participants engaged in any content and maximal engagement relative to assessment time stamps.

Attrition bias and reporting bias is largely uncaptured from the existing measures of engagement and the lack of systematic assessment of mental health diagnostics at baseline, unwanted or adverse effects, and participant satisfaction with program and the perceived usability of the learned skills. A meta-analysis revealed that the average attrition rate is 24.1% at short-term follow up of smartphone-delivered mental health interventions (Linardon & Fuller-Tyszkiewicz, 2020). Q-Life is not strictly a smartphone application, rather it is an internet-based platform, but it would be unsurprising if attrition rates mirrored such rates. Quantifying and investigating participant drop-off would be valuable for any e-mental health platform. Examples of questions to ask are "When do participants drop off? Why do they drop off? Is it due to adverse effects? Is it content-related or time of year-related?"

Relatedly, patient reported experience measures are a crucial part of the gold standard value-based healthcare and for a higher quality program (Canadian Foundation for Healthcare Improvement, 2020). E-mental health programs are no exception. There were formal approaches to soliciting, collecting, and analysing user feedback regarding participant reported measures for Q-Life. That said, the experiential and qualitative

feedback data was not shared with the researcher for the present study because there was no way to connect the data to participant outcome measures. User experience matters for contextualizing outcome measures and would be valuable to compare the two data sets directly. User experience evaluation might include user satisfaction, ease of use, the degree to which the user felt included or represented, etc. Q-Life is focused extensively on participant-reported outcome measures and currently, there is no direct connection of participant reported-experience measures to participant-reported outcome measures. Participant-reported experience measures can be valuable for contextualizing outcome measures and directing future program changes and evaluations. The 'National Standard' (Canadian Standards Association Group, 2020) holds post-secondary institutions responsible for monitoring the execution and ongoing sustainability of programs and regularly revieing and responding to performance results. As such, it would be highly advantageous for e-mental health services designed for the post-secondary setting and aiming to appeal to post-secondary institutions' senior management to incorporate these elements into evaluation metrics (as is also the implementation gold standard, RE-AIM, in Appendix B).

E-mental health programs of the future, including Q-Life, are encouraged to formalize their pathways for receiving, collecting, and analysing participant-reported experience measures prior to program launch with refinement throughout implementation and to connect these experience measures to outcome measures. A more robust evaluation of characteristics of participants and their experience across the spectrum of engagement is important for transparency and for a truer evaluation of the reach and effectiveness of an e-mental health program.

Logged Lifestyle Behaviours and Mentalities

Unlike what was hypothesized, logged lifestyle behaviours and mentalities did not predict improvements in QES. Of all the logged lifestyle behaviours, only nutrition was found to show minor statistical significance in predicting QES at T2, but it added a negligible amount of variance explained as compared to the primary model with just baseline QES. In a Canadian sample, eating well was found to be a commonly employed

coping mechanism for mental health during the pandemic (Faulkner et al., 2020) which is similar to the present study. Given that the literature highlights an importance of healthful lifestyle behaviours in sustaining mental health, it is surprising that other logged health behaviours were not predictive of improvements in QES. Physical activity was another coping mechanism for mental health commonly employed by Canadians during the pandemic (Faulkner et al., 2020). One of the major contributors to the uptick in mental health concerns during the onset of the pandemic were related to elements of well-being including disrupted sleep patterns (Son et al., 2020). North American college students with health-as-a-value report engaging in health-promoting activities like physical activity more and health as a value has a positive relationship with psychological health (Burris et al., 2009). That said, Faulkner and team (2020) also found the greatest de-emphasis on physical activity as a coping mechanism for mental health during the pandemic, which may have been a similar case in the present study and is why a lack of relationship between logged sleep and improvements in QES.

Equally notable was the lack of significance in logged mentalities predicting improvements in QES, which is contrary to what was predicted. Lack of emotional clarity and regulation has been associated with unhealthful, impulsive behaviours in Canadian university students (Miller & Racine, 2022). Dispositional optimism - the tendency to believe that one will generally experience good versus bad outcomes - in students is associated with better psychological health, perceived social support, quality of life, life satisfaction, adaptive coping, and health-promoting behaviours (Burris et al., 2009). Religiousness, or, more specifically, the social relationships and coping ability within religiousness have been found to be inversely related to mental distress (Burris et al., 2009). In contrast, the present study suggests no discernable relationship between logged positive mentalities and T2 QES.

Literature supports that lifestyle behaviours and mentalities are positively associated with resilience and well-being. The lack of relationship to logged behaviours in this study suggest that the logging data may not be capturing behaviours and mentalities relationship to well-being and resilience. It is possible that there is a lack of

construct validity. This is likely due to the formatting of the logging questions not capturing the *quality* of behaviours. Simple yes/no questions that participants can respond to at inconsistent and variable times are unlikely to capture what is truly happening in the sample in terms of lifestyle behaviours and mentalities over time. Simple self-tracking (i.e., logging) of mentalities and behavioural proxies to well-being is not always a beneficial management strategy (Kelley et al., 2017). Capturing the quality and nature of these behaviours and mentalities is necessary to turn self-tracking into a useful tool for students to infer connections between behaviours in their control and their well-being and reflect on them (i.e., self-monitoring) rather than simply the frequency of their occurrence. Self-monitoring often involves periodic measurement, recording of target behaviours, *and* self-evaluation (Orji et al., 2018). Self-monitoring is meant to, at its best, reveal problem behaviour, provide real and concrete information, foster reflection, make people assume responsibility for their behaviour, and create awareness and raise consciousness about health and wellness (Orji & Moffatt, 2018). Simple recording of quantity means missing out on rich data of the quality of the target behaviours. It is important for students to log the behaviour and mentalities to recognize patterns, but also to monitor of the quality of target behaviours and mentalities. To promote self-monitoring may mean the incorporation of standardized brief measures of the lifestyle behaviours and mentalities that students can reference against healthcare guidelines and recommendations for targeted behaviours. For instance, incorporation of the standardized measure of physical activity known as the physical activity vital sign (Exercise is Medicine Canada, 2021; Fowles et al., 2018) to be administered intermittently may better capture behaviour and its relationship with QES. Relatedly, it may also be worth considering whether participants should complete logging and monitoring daily. A study exploring the strengths and weaknesses of the self-tracking and self-monitoring strategy revealed that while self-monitoring can facilitate health and wellness by creating awareness and fostering reflection and accountability, it can also provoke health disorder and be tedious and discouraging (Kelley et al., 2017; Orji et al., 2018). Perhaps weekly logging of behaviours and

mentalities would be more comfortable for participants and better capture their behaviour and mentalities. The 'National Standard' upholds that programs should encourage and train student agency in self-identify mental health needs and developing self-management skills so as to recognize and respond to signs of declining mental health (Canadian Standards Association Group, 2020). Teaching tools to students to effectively self-monitor health behaviours and mentalities contribute to upholding the 'National Standard'.

Results showed that T2 QES was best predicted by T1 QES which provokes the question of the nature of resilience and well-being. While resilience may not be a fixed trait, it is important for e-mental health programs to acknowledge the capacity for resilience and well-being that users are beginning with. Literature stresses the heavy influence of 'environmental resilience' – that is, the quantity, quality, and relevance of services that an individual can access in their community (Ungar et al., 2008). Access to well-being and resilience services across the SC2.0 spectrum that are designed for implementation with a specific population in mind may bolster the baseline resilience and well-being of students. Appreciation of baseline levels of resilience and pathways to resilience comes from listening to those with lived experience during program design. I.e., designing population-specific resources and/or services that meets individuals where they are means including ideas and decisions from the targeted audience into design (Cornish, 2021). Cornish's (2021, p.92) Distributive Design Cycle (Appendix K) – which includes those with lived experience as program designers – and reciprocal mentoring (where those with lived experience and program designers both take on the roles of mentor and mentee) would be a valuable resource for e-mental health program development and implementation.

Research Question Three: Subgroup Differences in Effectiveness and Reach

Q-Life Effectiveness Across Q-Life Program Versions

Given that each subsequent version of the Q-Life program was meant to be a refined version of the prior, findings partially confirmed the initial hypothesis. QES was significantly higher from T1 to T2 across all three versions and there were significant

main effects for program version. Q-Life V3 had a mean QES higher than V1 and V2 (the former insignificant and the latter significant), but V1 was significantly higher than V2. Had the hypothesis been true, V1, V2, and V3 would each have a progressively higher mean QES. What is likely the reason for all three versions having similar effects on QES is the variability in program implementation contexts. Although each version was a 'development' of the prior, V2 was implemented at a different university that is much smaller than the university in V1. While V1 and V3 were both implemented at the same university, V3 was implemented in a specific class at that university that was highly incented, and therefore, not contextually relevant to the implementation of V1 or V2.

Q-Life Effectiveness Across COVID-19

Contrary to what was predicted, the improvement in QES score was consistently 8-9% across different COVID-19 impact. These results suggest that Q-Life might retain similar effectiveness even in the face of a pandemic. During the height of the pandemic, students were encouraged to maintain structure and routine in their day-to-day-lives (Kost, 2021; Ungar, 2020). Structure and routine have proven helpful in maintaining resilience during mass crises (Ungar, 2020). Where Q-Life is online and its accessibility remained unaffected by COVID-19 closures and safety protocols, perhaps the steady effectiveness of the program is related to its consistency and accessibility for students.

On the other hand, it is possible that the non-variability in the pre to post changes of QES by COVID-19 impact suggest that the Q-Life assessment is not sensitive enough to capture changes in resilience and well-being that come with a massive international stressor such as a pandemic. Using a validated measure of related constructs such as the COVID Stress Scale (Taylor et al., 2020) - which measures stress related to the pandemic – may have provided useful data to compare Q-Life assessment results to.

Engagement by Demographics and Q-Life Version

The average participant in Q-Life is a white, female, 18-year-old student. In V1, 79% of students identified as 'female'. Dalhousie University census data revealed that

students who identified as a woman/female made up 55% of the student population (Dalhousie University, 2017, 2019). In V2 Q-Life, 79% identified as 'female'. A 2021 Acadia University census report showed that 69% of students identified as 'woman'. This suggests that Q-Life participants are under-representing the male population and that in this study, there is a considerable proportion of the male student body that was not reached. It is common for female-identifying university students to more often report psychosomatic symptomology and be more likely to seek and receive psychological care, compared to male counterparts (Burris et al., 2009). Male-identifying individuals generally face gender-role stereotypes and unique factors that can prevent their accessing mental health care (Mental Health Commission of Canada, 2022a). Where there was no demographic data available to compare to V3 Q-Life participants (who were all sampled from the same undergraduate kinesiology course), it is difficult to establish V3's reach, but results of the present study showed non-significant main and interaction effects across gender and Q-Life version MANOVAs.

In the present study, only 1-2% of participants identified as neither male nor female but as a different gender identity ('other') across Q-Life versions. A 2021 Dalhousie University census showed that 1.2% of students identified as 'other' from male and female. A 2021 Acadia University census revealed that 0.9% of students identified as non-binary or two-spirited (which would have been categorized as 'other' in the present study) (Acadia University, 2021). Results of the present study, when compared to university data, suggest good reach with the non-male and non-female-identifying population.

The 'National Standard' calls for inclusiveness of gender, gender expression, and gender identity. While Q-Life reach may be acceptable in reach, this does not mean that Q-Life is achieving equity, diversity, and inclusion. For instance, there was no response option which allowed for transgender individuals to self-identify. While a trans individual may identify with male or female gender identities, their lived experience with mental health, wellbeing, and resilience as a marginalized group is likely to differ significantly from cis-gender individuals. To meet the 'National Standard' and health

authority guidelines, e-mental health platforms such as Q-Life would benefit from incorporation of strategies to recognize and speak to non-cisgender, non-female, and non-Caucasian experiences of resilience and well-being (Canadian Standards Association Group, 2020; Mental Health Commission of Canada, 2020). An example of improving inclusivity would be provide more inclusive options for participants to see themselves in Q-Life upon first interaction (i.e., during data collection via the assessment). Options such as 'other', 'unspecified', 'prefer to self-describe' may technically capture gender options beyond 'male' and 'female', but they fail to communicate that Q-Life recognizes, welcomes, and includes gender diverse and gender non-conforming participants. Q-Life offered a relatively limited list of response options as compared to the multitude of gender identities that are formally recognized by the Canadian government and national health authorities (Mental Health Commission of Canada, 2022b; *What Does LGBTQ2+ Mean?*, 2019). Such a limited list may make the Q-Life appear unsafe for non-cisgender, gender diverse, and gender non-conforming individuals. Q-Life may not be reaching students of non-cisgender and identities because it does not cater to the gender differences or address varying stigmas in mental health and well-being around access and care (Comacchio et al., 2022; Marie et al., 2022; Mental Health Commission of Canada, 2022b; Mizock & Mueser, 2014; Røysamb et al., 2002; Statistics Canada, 2020). A comparison to Acadia and Dalhousie Universities' student body suggests that this is a plausible explanation. In 2021, 1.53% of Acadia University students identified as trans-gender (Acadia University, 2021). There is no way of understanding reach with this demographic group due to the limitations in response options Q-Life participants were able to choose from. Similarly, from 2016 to 2019 university-wide census, 6-8% of Dalhousie University student respondents identified with the 2SLGBTQ+ group (Dalhousie University, 2019). It is important to note that the 2SLGBTQ+ includes sexual orientation as well as gender identity (two distinct elements of identity). That said, diverse gender identities are part of the 2SLGBTQ+ demographic group as a whole and there is no way to compare Q-Life reach to due to the limitation in response options.

Sexual and gender minority students reported significantly lower senses of school belonging and flourishing than their cisgender heterosexual counterparts (Parr, 2022) and are important groups to reach. Dalhousie University's diversity and equity report outlines goals which are also relevant to e-mental health programs and Q-Life in increasing reach and representativeness of their sample: increase representation of 2SLGBTQ+ leaders (Dalhousie University, 2019). While the university was referring to faculty and staff, e-mental health programs and Q-Life could potentially reach a greater percentage of the 2SLGBTQ+ student body by increasing diversity and representation within their content. For a thriving community and culture of well-being, it is critical that e-mental health programs such as Q-Life recognize structural stigma and are proactive and responsive in incorporating practices aimed at improving equity, diversity, and inclusion. It is worth acknowledging that Q-Life did provide 'other' gender-identity response options in the VA assessment first launched in 2017 without conflating them with sexual orientation (i.e., grouping with 2SLGBTQ+ as a whole) before Dalhousie University as an institution did. This is an example of proactive action. That said, as outlined in the 'National Standard' (Canadian Standards Association Group, 2020), continuous improvement is necessary, and Q-Life is not yet up to gold standard with equity, diversity, and inclusion.

That said, collecting gender data is only appropriate when it serves a bona fide purpose in research such as using that data to better understand demographic groups' experiences to better speak to diverse life experiences and provide more tailored services. Such specificity is difficult to accomplish from a small quantitative data set. It may be more appropriate for Q-Life and mental health resources in general to collect such data should they have an expansive sample size that allows for powerful subgroup analyses. Otherwise, qualitative data that informs program development throughout the design stages may be more appropriate.

When compared to the student population at Dalhousie University, there was reasonable reach with non-Caucasian students. Approximately 14-15% of Dalhousie students identified as a 'racialized and racially visible person' (Dalhousie University,

2017, 2019). In 2021, 77% of students identified as 'white' (i.e., Caucasian) meaning approximately 23% identified with a non-white, racialized identity (Acadia University, 2021). In the present study, 15% to 32% of students identified as racialized/non-Caucasian. Q-Life has reasonable reach with the non-Caucasian student population. Non-Caucasian students report experiencing mentally unhealthy days almost twice as often as Caucasian students (Burris et al., 2009). Racial and ethnic minority students experienced significantly lower senses of school belonging and flourishing than white students (Parr, 2022). Non-Caucasian students also face disproportionate stigma, systemic inequity, and discrimination as compared to their Caucasian counterparts (Mental Health Commission of Canada, 2021a; Statistics Canada, 2020) and as such, need a nuanced approach when trying to reach and support them with mental health interventions (Goodwin et al., 2021). E-mental health programs of the future are encouraged to explore practices which foster safe spaces and support of these populations so that they may be better understood and included in e-mental health solutions.

Meeting the 'National Standard' is critical for creating a high-quality and relevant e-mental health programs. To create a service that meets the 'National Standard' (Canadian Standards Association Group, 2020) itself and that aids post-secondary institutions in implementing the 'National Standard', program developers and evaluators must ensure "active and meaningful participation from all groups representing and reflecting the diversity of students, including those with lived experience and students from equity-seeking groups" and do so throughout all steps of the planning process (Canadian Standards Association Group, 2020, p.24). Dr. Peter Cornish and team developed a framework for incorporating the voices of those with lived experiences into program design and development; it is called the Distributive Design Cycle (see Appendix K) (Cornish, 2021). Cornish's Distributive Design Model (Cornish, 2021) is a framework for incorporating the voices of those with lived experiences so that program architects can create a more inclusive and culturally relevant experience. It would be valuable to gather insight and inspiration from those

with lived experiences of mental health, well-being, and resilience from a variety of perspectives – including gender identity and racial identity – to understand how to speak to the experiences of and mitigate stigma for equity-seeking groups from data collection to data utilization. E-mental health programs of the future are encouraged to explore practices which foster safe spaces and support of these populations so that they may be better understood and included in e-mental health solutions. Measures such as the Schwartz Center Compassionate Care Scale and the Dimensions of Person-Centered Care Instrument have been recommended for general health-care settings by the Mental Health Commission of Canada (Stuart, 2021); perhaps adapted versions of such metrics could be incorporated to learn how to better appeal to the marginalized populations currently under-served by e-mental health programs such as Q-Life.

Relatedly, the present study had relatively small sample sizes when divided by demographic groups. A larger sample would be necessary to avoid risk of identification and to maintain statistical power in demographic subgroup comparisons. Analyses that could not be completed in the present study (due to limited demographic subgrouping) included studying attrition and engagement and well-being and resilience outcomes by demographic subgroups. While reach was reasonable relative to the populations where the samples were drawn from, it was not enough to allow for cross-demographic group comparisons. Future evaluations and studies would benefit from drawing from larger populations (perhaps more schools) and perform proactive power and sample size calculations.

Results suggest that despite changes in content language across program versions that was aimed at including diverse student populations, there was no significant differences in program reach across varying demographics. The MHCC outlined several considerations in a framework for post-secondary institutions trying to make informed decisions in selecting mental health apps. This framework advocates for seeking out solutions that are evidence based; gender responsive; culturally appropriate; user-centered; risk-accountable; innovation-friendly; transparent in their intent and nature; consistent with ethical norms; and internationally informed (Mental

Health Commission of Canada, 2021c). Currently, Q-Life cannot be considered gender responsive, culturally appropriate, or internationally informed.

Future e-mental health programs and their evaluators would benefit from incorporating metrics for monitoring aspects of structural stigma in the program to make them practical resource more deliberately for marginalized populations. Ideally, such measurements would be grounded in client-directed, holistic, person-centered frameworks, and be generalizable and psychometrically sound (Stuart, 2021) before being incorporated into e-mental health programs.

Limitations

The primary overall limitation of this research was inherent in it being action research and therefore, the researchers were at the mercy of how dynamically this program and assessment was implemented in its 'real world' environment. This established many challenges from a data evaluation standpoint, none of which were the choice of the researcher, as the goal of this project was to evaluate what was done, not design a study that tested specific variables. The first specific limitation in this regard is an issue with the sample size. There were no power and sample size estimations calculated made prior to the collection of this data and its use in the present study given its secondary nature. Smaller sample sizes and uneven group sizes impacted the power of some statistical analyses and group comparisons. Restricted sample sizes mean that the present study is limited in terms of its generalizability and external validity. Evaluations of e-mental health programs would benefit from calculating power and sample size estimates prior to closing program registrations and collecting evaluation data. Related to the sample size limitation is the limitation of time constraints. Q-Life being a real-world service developed and offered by a smaller organization with limited funds and time, the present study had to keep up with fast-paced business growth and adaptations to stay relevant to Q-Life development and refinement. Ideally, a larger set of secondary data would be collected and analysed. Additionally, as with any real-world program, there are uncontrollable confounding and extraneous variables which impact

implementation of an intervention that could not be captured to the same degree in a randomized control study.

The other primary limitation of this research was the absence of a defined control group. Although there was a '0% engagement comparison group' there was no way to determine the accuracy or validity of the 0% engagement as this measure was only related to the amount of video content that participants downloaded, not how much the participant may or may not have completed on the student companion. As such, there is no true comparison of pre-post effects of doing the assessment only. The consistent effects of an 8-9% improvement in QES scale score, by version, by pre-post COVID, or different engagement groups, may or may not be a testing effect. There was a concerted effort to have a test-retest control group, but after much promotion and even with the presence of incentives, there were insufficient participants recruited to the test-retest control group after two years. The creation of an active and/or inactive control group would be valuable in the evaluation of Q-Life's effectiveness. Without a control group, there is no way of knowing with certainty that the pre to post changes in QES were a result of the Q-Life program directly.

As with many interventions, there is a possibility of sampling bias since those who were sampled likely had a pre-existing affinity to mental health, well-being, and resilience services. Registration for Q-Life was voluntary in versions 1 & 2 and were part of a health and wellness university course in Version 3, so, regardless of their engagement over time, those who participated would have likely had an initial awareness of well-being and resilience training and may have felt that they could benefit from such training. This is particularly likely with V1 and V2 Q-Life participants where incentive to participate was for a 1 to 2% bonus points towards a course grade. For V3 Q-Life participants, however, this sampling bias may have less of an effect on results as this group was incentivized with 10% of a final course grade coming from Q-Life participation. The differences in incentivization across groups also likely led to a reporting bias that that impacted the present study results.

Another limitation to the present study is that there is only self-report quantitative data to draw conclusions about extremely subjective experiences and processes such as well-being and resilience. Survey-style assessments are known to have a lack of flexibility and lack of depth as to the participant experience. Future evaluations of Q-Life may consider employing diverse methods in assessing research constructs and incorporate qualitative techniques to create a more holistic picture of the student experience throughout the program. There is intention to use journaling data for sentimental analysis, though the focus of this development has been for development of artificial intelligence in a growth-management platform for JackHabbit Inc. Moreover, the present study did not measure adverse effects of the intervention. Adverse effects are as important as intended positive effects in guiding program development.

There were exploratory and confirmatory factor analyses performed on both VA and VB assessments. That said, neither analysis was used in the development from the VA assessment to the VB assessment. The VB assessment has also undergone exploratory and confirmatory factor analysis; the result was a 34-item measure accounting for 60% of variance (Koppernaes et al., 2021). This 34-item measure derived from the VB assessment was validated against the Connor-Davidson 2-item resilience measure. This means that there are limitations in the Q-Life assessment as an instrument as it has not undergone heavy validity and reliability testing.

Finally, secondary data did not include any long-term follow-up measures of well-being and resilience. As such, there is no way of knowing whether students retained their improved QES after T2. Formalized follow-up assessments to observe longer-term impact and effectiveness are generally encouraged in evaluations of effectiveness.

Strengths

This action research study exemplified real-world implementation of a mental health intervention aimed at promoting well-being and resilience. There was a relatively

large data sample across several versions of the program and two universities which showed consistently positive outcomes in engagement and well-being and resilience measures. The data also allowed for comparison in pre-COVID-19 and COVID-19-impacted groups, which is unique to the present study as far as the researcher knows. Moreover, the program was asynchronous and self-administered which translates to scalability.

Conflicts of Interest

There are several conflicts of interest for the researcher to declare. Foremost, was the dual role of the researcher created by the Mitacs Accelerate program. The funding which allowed the researcher to complete the present study also meant the researcher completed a paid internship with Jackhabbit Inc. There was a non-disclosure agreement which the researcher signed as an intern to maintain the assets of Jackhabbit Inc. Rights to the data and publishing belong to Jackhabbit Inc.

As well, Dr. Jonathon Fowles, the researcher's supervisor, does have invested financial interest in Jackhabbit Inc. as a minority shareholder and is the company Research Lead. Drs. Jeffery Zahavich, Shannon Johnson, and Chris Shields are research advisors to the Q-Life developers, Jackhabbit Inc. The V3 Q-Life program was implemented with Dr. Zahavich's first year undergraduate kinesiology course as a pilot for including well-being topics in course content. Finally, the data collected at Acadia University was collected under two unrestricted grants from the RBC Foundation.

Chapter 6: Conclusions

Q-Life participation was effective with significant improvements in QES and, by extension, elements of well-being and resilience in post-secondary students across all three program versions and COVID-19 impact. Moreover, incentivization improves engagement in well-being and resilience programs. Results of the present study highlight several recommendations for future e-mental health program development and evaluation research and directions for Q-Life program development.

Findings Relevant to Q-Life Specifically

There are key recommendations for the development of Q-Life that can be drawn from the present evaluation. The evidence suggests that for improved reach and effectiveness with Q-Life:

- Granularize engagement data to investigate a dose-effect and ensure that all elements of the program are included in the engagement data
- Avoid use of Yes/No response options for logging/behaviour monitoring and consider transition to weekly logging rather than daily.
- Compare QES results to PSSI, BHM-20, and possibly grade point average results to assess construct validity of the Q-Life assessment
- Test Q-Life in an unincentivized model to assess reach and engagement

Findings Relevant to E-mental Health Program Development and Evaluation Research

There are several takeaways from the present research that are more broadly applicable to future research and development of e-mental health programs:

- Optimize engagement data granularity to assess reach and to understand what influences e-mental health program effectiveness across demographic groups
- Self-monitoring may better reflect the role of behavior and mentality on resilience and well-being than simple logging and may be more effective at supporting resilience and well-being when used intermittently rather than daily.
- Baseline resilience and well-being is a key predictor of the effectiveness of resilience-building and well-being programs. To target baseline resilience levels and capacity for resilience, consider using the distributive design model and reciprocal modeling in developing e-mental health services and creating access to them.
- Ensure methods of determining convergence and divergence validity with validated measures of relevant constructs surrounding the targeted mental health construct
- Be conscientious in demographic data collection methods to ensure that marginalized populations feel included in e-mental health programs
- Establish concrete strategies for reaching and helping marginalized populations. This may include incorporating measures of structural stigma and including members of the target audience with lived experience during key phases of program development.

Dissemination

Results will be disseminated to Jackhabbit Inc. and their partner, Studentcare ASEQ - the health insurance provider to 50+ student associations, with a network of over 2,500 professionals across Canada. Key findings of this study will be incorporated

into the development and delivery of Q-Life program and the Jackhabbit e-mental health resource delivery platform. The Jackhabbit e-mental health platform will implement machine learning and growth-management to help users autonomously navigate resources across SC2.0 and highlight resources that may be particularly relevant or useful to them, even as their needs change. The algorithm behind the platform will be informed by the present study. Should the above recommendations from the present evaluation be incorporated, future Q-Life evaluations should scrutinize Q-Life against the Behaviour Change Review Scale (Alslaity et al., 2022) to assess its behaviour change potential.

Final Thoughts

With more development, Q-Life can become a viable option for post-secondary students and their academic institutions in mitigating the mental health crisis. There are also lessons to be learned for e-mental health programs in general from the evaluation of singular e-mental health programs. Developing and promoting access to effective resilience well-being programs in the post-secondary environment is important for inspiring creativity, innovation, and lifelong learning in students and, subsequently, in society in general (Canadian Standards Association Group, 2020).

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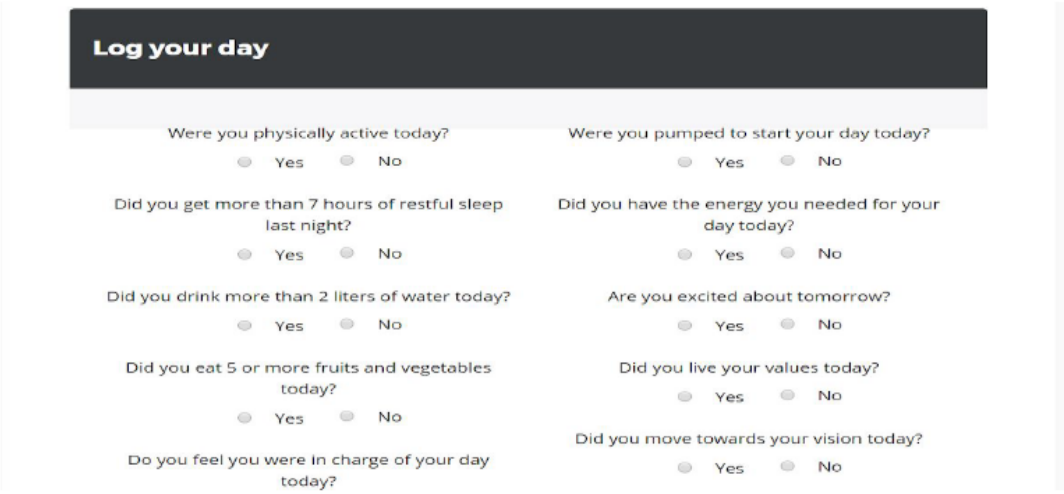
Appendix A: Details of Logging Items

Self-appraisal R-Charge 2: Logging

As discussed above, logging is to keep yourself accountable. When you log, you want to be as honest as possible with yourself. My omitting or twisting the reality of the situation, you are only lying to yourself.

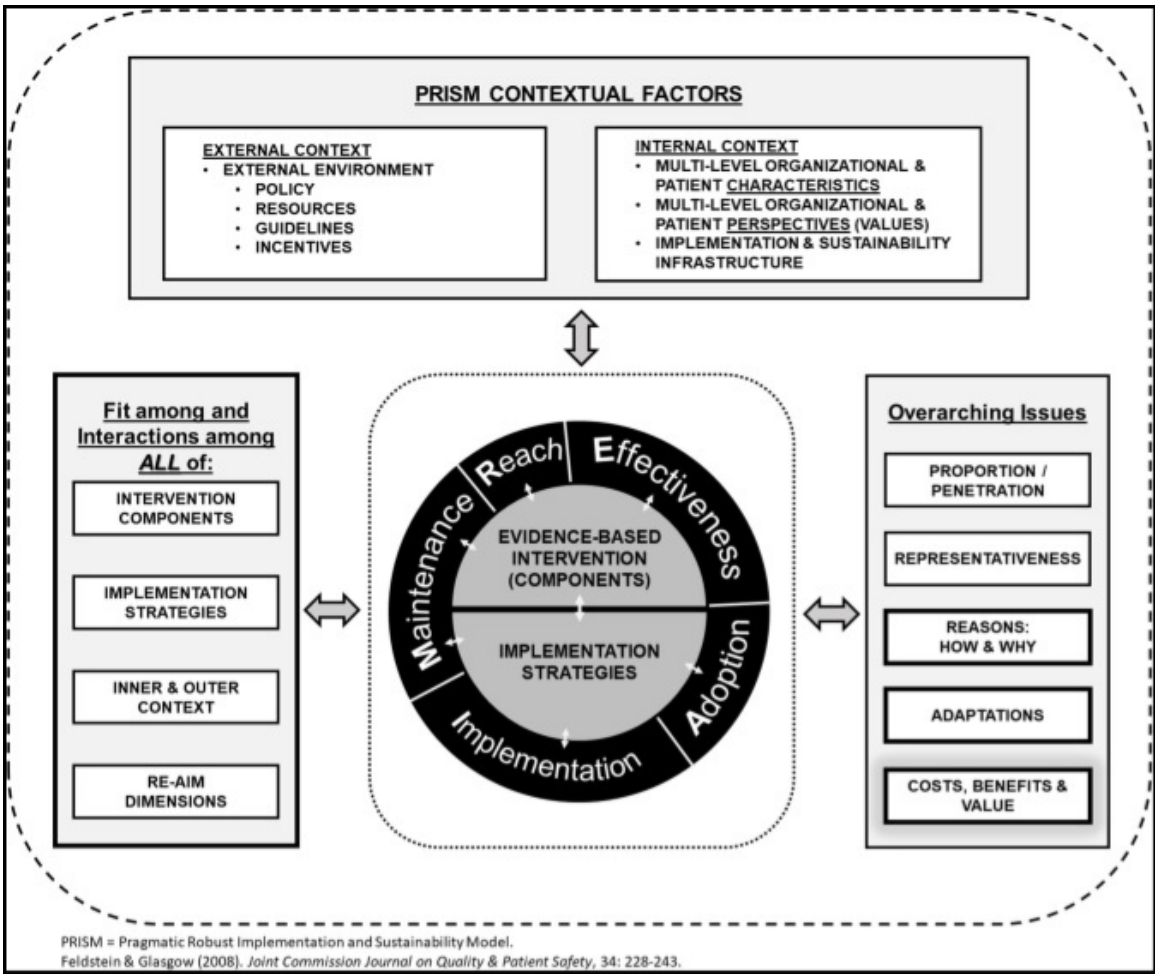
Charge 2, activity 1: logging to evaluate yourself.

We use 10 simple questions to help keep you on track for the Q-Life. These 10 questions are about daily behaviours that support your R-battery.



You can then reflect on how many *yes* and *no* answers you gave during certain periods of time, life events, or people you've been in company with.. You can more easily spot trends or patterns in how you're feeling and can thereby look for relationships between your feelings and your R-charging behaviour. You can determine what charges your R-Battery and what depletes it. You can do your own correlations and comparisons. The more green you create, the more likely you will fuel your R-Battery and improve your Q-Life.

Appendix B: The RE-AIM Framework of Implementation Science



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Appendix C: Details of the QES Common

1. I pay attention to my resilience.
2. I am motivated to improve my resilience.
3. I think about what I can do to improve my resilience.
4. My environment affects my choices in life.
5. When I make a mistake, I give myself a break.
6. My values assist me in make good decisions.
7. My vision keeps me focused on my life goals.
8. My social network at this university is positive.
9. I have a good laugh each day.
10. Journaling helps me make better decisions.
11. Journaling helps me organize my thoughts.
12. Journaling has a positive impact on my emotions.
13. I take time to journal.
14. Journaling makes me more self aware.
15. I keep an exercise routine.
16. I wake up feeling rested.
17. I take time to live in the moment.
18. I am more positive than negative.
19. I take [the] time to be grateful.
20. I keep up with my daily routines even at difficult times.
21. I work toward achieving my goals.
22. My day is organized.
23. I block my time effectively (e.g., study time, personal time, physical activity).
24. When in a difficult situation, I can usually find my way out.
25. I am a good problem solver.
26. When I fail at something important to me, I become consumed by feelings of failure.
27. Worry gets in the way of my success.
28. It seems like most people are handling their lives better than I am.
29. If something can go wrong for me, it will.
30. I have a strong sense of purpose.

** In the red box are the 7 items that are included in the V2 'resilience' data field, but not in the V1 'resilience' data field. In V1, they are in the 'additional' data field. **

Appendix D: Comparing QES Across Q-Life Version and Time

Descriptive Statistics

	Q-Life version	Mean	Std. Deviation	N
Time 1 Q-Life experience score	1	.6623	.08638	226
	2	.6165	.10217	127
	3	.6884	.08377	71
	Total	.6529	.09433	424
Time 2 Q-Life experience score	1	.7516	.11414	226
	2	.7148	.11166	127
	3	.7804	.08965	71
	Total	.7454	.11172	424

Box's Test of Equality of Covariance Matrices[a]

Box's M	16.229
F	2.681
df1	6
df2	476729.443
Sig.	.013

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + QLifeVersion Within Subjects Design: Time

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.436	325.554[b]	1.000	421.000	<.001	.436
	Wilks' Lambda	.564	325.554[b]	1.000	421.000	<.001	.436
	Hotelling's Trace	.773	325.554[b]	1.000	421.000	<.001	.436
	Roy's Largest Root	.773	325.554[b]	1.000	421.000	<.001	.436
Time * QLifeVersion	Pillai's Trace	.002	.361[b]	2.000	421.000	.697	.002
	Wilks' Lambda	.998	.361[b]	2.000	421.000	.697	.002
	Hotelling's Trace	.002	.361[b]	2.000	421.000	.697	.002
	Roy's Largest Root	.002	.361[b]	2.000	421.000	.697	.002

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: QES

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: QES

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	1.482	1	1.482	325.554	<.001	.436
	Greenhouse-Geisser	1.482	1.000	1.482	325.554	<.001	.436
	Huynh-Feldt	1.482	1.000	1.482	325.554	<.001	.436
	Lower-bound	1.482	1.000	1.482	325.554	<.001	.436
Time * QLifeVersion	Sphericity Assumed	.003	2	.002	.361	.697	.002
	Greenhouse-Geisser	.003	2.000	.002	.361	.697	.002
	Huynh-Feldt	.003	2.000	.002	.361	.697	.002
	Lower-bound	.003	2.000	.002	.361	.697	.002
Error(Time)	Sphericity Assumed	1.917	421	.005			
	Greenhouse-Geisser	1.917	421.000	.005			
	Huynh-Feldt	1.917	421.000	.005			
	Lower-bound	1.917	421.000	.005			

Tests of Within-Subjects Contrasts

Measure: QES

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Linear	1.482	1	1.482	325.554	<.001	.436
Time * QLifeVersion	Linear	.003	2	.002	.361	.697	.002
Error(Time)	Linear	1.917	421	.005			

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.
Time 1 Q-Life experience score	Based on Mean	1.322	2	421	.268
	Based on Median	1.289	2	421	.277
	Based on Median and with adjusted df	1.289	2	396.198	.277
	Based on trimmed mean	1.318	2	421	.269
Time 2 Q-Life experience score	Based on Mean	2.449	2	421	.088
	Based on Median	2.385	2	421	.093
	Based on Median and with adjusted df	2.385	2	409.966	.093
	Based on trimmed mean	2.422	2	421	.090

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

Tests of Between-Subjects Effects

Measure: QES

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	336.533	1	336.533	21358.365	.000	.981
QLifeVersion	.489	2	.245	15.533	<.001	.069
Error	6.633	421	.016			

Estimated Marginal Means for Q-Life Version:

Estimates

Measure: QES

Q-Life version	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.707	.006	.695	.719
2	.666	.008	.650	.681
3	.734	.011	.714	.755

Pairwise Comparisons

Measure: QES

(I) Q-Life version	(J) Q-Life version	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	.041*	.010	<.001	.018	.065
	3	-.027	.012	.070	-.056	.002
2	1	-.041*	.010	<.001	-.065	-.018
	3	-.069*	.013	<.001	-.100	-.037
3	1	.027	.012	.070	-.002	.056
	2	.069*	.013	<.001	.037	.100

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

Measure: QES

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.245	2	.122	15.533	<.001	.069
Error	3.317	421	.008			

The F tests the effect of Q-Life version. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Estimated Marginal Means for Time:

Estimates

Measure: QES

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.656	.005	.646	.665
2	.749	.006	.737	.761

Pairwise Comparisons

Measure: QES

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.093*	.005	<.001	-.103	-.083
2	1	.093*	.005	<.001	.083	.103

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.436	325.554[a]	1.000	421.000	<.001	.436
Wilks' lambda	.564	325.554[a]	1.000	421.000	<.001	.436
Hotelling's trace	.773	325.554[a]	1.000	421.000	<.001	.436
Roy's largest root	.773	325.554[a]	1.000	421.000	<.001	.436

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Estimated Marginal Means Q-Life Version By Time:

3. Q-Life version * Time

Measure: QES

				95% Confidence Interval	
Q-Life version	Time	Mean	Std. Error	Lower Bound	Upper Bound
1	1	.662	.006	.650	.674
	2	.752	.007	.737	.766
2	1	.616	.008	.601	.632
	2	.715	.010	.696	.734
3	1	.688	.011	.667	.710
	2	.780	.013	.755	.806

Appendix E: Comparing QES Common Across Q-Life Version and Time

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Q-Life version	N	Percent	N	Percent	N	Percent
T1_QESCommon_Score	1	278	44.3%	350	55.7%	628	100.0%
	2	74	26.4%	206	73.6%	280	100.0%
	3	71	42.3%	97	57.7%	168	100.0%
T2_QESCommon_Score	1	278	44.3%	350	55.7%	628	100.0%
	2	74	26.4%	206	73.6%	280	100.0%
	3	71	42.3%	97	57.7%	168	100.0%
PercentChange_QESCommon	1	278	44.3%	350	55.7%	628	100.0%
	2	74	26.4%	206	73.6%	280	100.0%
	3	71	42.3%	97	57.7%	168	100.0%

Descriptive Statistics

	Q-Life version	Mean	Std. Deviation	N
T1_QESCommon_Score	1	.6461	.09264	278
	2	.6614	.08307	74
	3	.6611	.08179	71
	Total	.6513	.08938	423
T2_QESCommon_Score	1	.742686	.1183147	278
	2	.758649	.0954552	74
	3	.757746	.0961345	71
	Total	.748006	.1111403	423

Box's Test of Equality of Covariance Matrices[a]

Box's M	17.306
F	2.854
df1	6
df2	367908.462
Sig.	.009

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.392	270.966[b]	1.000	420.000	<.001	.392
	Wilks' Lambda	.608	270.966[b]	1.000	420.000	<.001	.392
	Hotelling's Trace	.645	270.966[b]	1.000	420.000	<.001	.392
	Roy's Largest Root	.645	270.966[b]	1.000	420.000	<.001	.392
Time * QLifeVersion	Pillai's Trace	.000	.001[b]	2.000	420.000	.999	.000
	Wilks' Lambda	1.000	.001[b]	2.000	420.000	.999	.000
	Hotelling's Trace	.000	.001[b]	2.000	420.000	.999	.000
	Roy's Largest Root	.000	.001[b]	2.000	420.000	.999	.000

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: QESCommon

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: QESCommon

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	1.352	1	1.352	270.966	<.001	.392
	Greenhouse-Geisser	1.352	1.000	1.352	270.966	<.001	.392
	Huynh-Feldt	1.352	1.000	1.352	270.966	<.001	.392
	Lower-bound	1.352	1.000	1.352	270.966	<.001	.392
Time * QLifeVersion	Sphericity Assumed	1.205E-5	2	6.025E-6	.001	.999	.000
	Greenhouse-Geisser	1.205E-5	2.000	6.025E-6	.001	.999	.000
	Huynh-Feldt	1.205E-5	2.000	6.025E-6	.001	.999	.000
	Lower-bound	1.205E-5	2.000	6.025E-6	.001	.999	.000
Error(Time)	Sphericity Assumed	2.095	420	.005			
	Greenhouse-Geisser	2.095	420.000	.005			
	Huynh-Feldt	2.095	420.000	.005			
	Lower-bound	2.095	420.000	.005			

Tests of Within-Subjects Contrasts

Measure: QESCommon

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Linear	1.352	1	1.352	270.966	<.001	.392
Time * QLifeVersion	Linear	1.205E-5	2	6.025E-6	.001	.999	.000
Error(Time)	Linear	2.095	420	.005			

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.
T1_QESCommon_Score	Based on Mean	1.181	2	420	.308
	Based on Median	1.201	2	420	.302
	Based on Median and with adjusted df	1.201	2	416.270	.302
	Based on trimmed mean	1.159	2	420	.315
T2_QESCommon_Score	Based on Mean	5.381	2	420	.005
	Based on Median	5.395	2	420	.005
	Based on Median and with adjusted df	5.395	2	414.624	.005
	Based on trimmed mean	5.413	2	420	.005

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + QLifeVersion
Within Subjects Design: Time

Tests of Between-Subjects Effects

Measure: QESCommon

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	286.487	1	286.487	18672.485	.000	.978
QLifeVersion	.045	2	.022	1.464	.233	.007
Error	6.444	420	.015			

Estimated Marginal Means for Q-Life Version:

Estimates

Measure: QESCommon

Q-Life version	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.694	.005	.684	.705
2	.710	.010	.690	.730
3	.709	.010	.689	.730

Pairwise Comparisons

Measure: QESCommon

(I) Q-Life version	(J) Q-Life version	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.016	.011	.518	-.043	.012
	3	-.015	.012	.592	-.043	.013
2	1	.016	.011	.518	-.012	.043
	3	.001	.015	1.000	-.034	.036
3	1	.015	.012	.592	-.013	.043
	2	-.001	.015	1.000	-.036	.034

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

Measure: QESCommon

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.022	2	.011	1.464	.233	.007
Error	3.222	420	.008			

The F tests the effect of Q-Life version. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Estimated Marginal Means By Time:

Estimates

Measure: QESCommon

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.656	.005	.646	.667
2	.753	.007	.740	.766

Pairwise Comparisons

Measure: QESCommon

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.097*	.006	<.001	-.108	-.085
2	1	.097*	.006	<.001	.085	.108

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.392	270.966[a]	1.000	420.000	<.001	.392
Wilks' lambda	.608	270.966[a]	1.000	420.000	<.001	.392
Hotelling's trace	.645	270.966[a]	1.000	420.000	<.001	.392
Roy's largest root	.645	270.966[a]	1.000	420.000	<.001	.392

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Estimated Marginal Means for Q-Life Version by Time

3. Q-Life version * Time

Measure: QESCommon

Q-Life version	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.646	.005	.636	.657
	2	.743	.007	.730	.756
2	1	.661	.010	.641	.682
	2	.759	.013	.733	.784
3	1	.661	.011	.640	.682
	2	.758	.013	.732	.784

Appendix F: Hierarchical Multiple Regression Predicting Time Two QES from Time One QES and Logging Variables

Descriptive Statistics

	Mean	Std. Deviation	N
Time 2 Q-Life experience score	.7534	.11048	360
Time 1 Q-Life experience score	.6590	.09402	360
Count of logged 'yes' to active	4.99	7.470	360
Count of logged 'yes' to fruit and veggies	4.52	7.426	360
Count of logged 'yes' to adequate sleep	6.08	8.575	360
Count of logged 'yes' to adequate hydration	4.78	8.121	360
Count of logged 'yes' to energy	5.88	8.295	360
Count of logged 'yes' to excited to start day	5.86	8.705	360
Count of logged 'yes' to feeling in charge of day	6.50	9.076	360
Count of logged 'yes' to feeling pumped	5.03	8.082	360
Count of logged 'yes' living by values	6.80	9.579	360
Count of logged 'yes' living by vision	6.56	9.510	360

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Time 1 Q-Life experience score[b]	.	Enter
2	Count of logged 'yes' to adequate hydration, Count of logged 'yes' to fruit and veggies, Count of logged 'yes' to active, Count of logged 'yes' to adequate sleep[b]	.	Enter
3	Count of logged 'yes' to feeling pumped, Count of logged 'yes' living by vision, Count of logged 'yes' to excited to start day, Count of logged 'yes' to energy, Count of logged 'yes' to feeling in charge of day, Count of logged 'yes' living by values[b]	.	Enter

a. Dependent Variable: Time 2 Q-Life experience score

b. All requested variables entered.

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.573[a]	.328	.326	.09068	.328	174.909	1	358	<.001	
2	.591[b]	.350	.340	.08973	.021	2.911	4	354	.022	
3	.595[c]	.354	.333	.09021	.004	.374	6	348	.895	2.059

a. Predictors: (Constant), Time 1 Q-Life experience score

b. Predictors: (Constant), Time 1 Q-Life experience score, Count of logged 'yes' to adequate hydration, Count of logged 'yes' to fruit and veggies, Count of logged 'yes' to active, Count of logged 'yes' to adequate sleep

c. Predictors: (Constant), Time 1 Q-Life experience score, Count of logged 'yes' to adequate hydration, Count of logged 'yes' to fruit and veggies, Count of logged 'yes' to active, Count of logged 'yes' to adequate sleep, Count of logged 'yes' to feeling pumped, Count of logged 'yes' living by vision, Count of logged 'yes' to excited to start day, Count of logged 'yes' to energy, Count of logged 'yes' to feeling in charge of day, Count of logged 'yes' living by values

d. Dependent Variable: Time 2 Q-Life experience score

ANOVA[a]

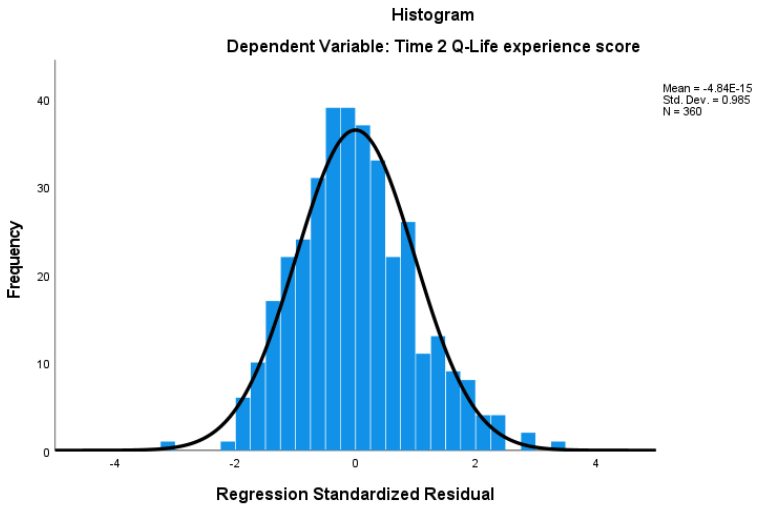
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.438	1	1.438	174.909	<.001[b]
	Residual	2.944	358	.008		
	Total	4.382	359			
2	Regression	1.532	5	.306	38.058	<.001[c]
	Residual	2.850	354	.008		
	Total	4.382	359			
3	Regression	1.550	11	.141	17.319	<.001[d]
	Residual	2.832	348	.008		
	Total	4.382	359			

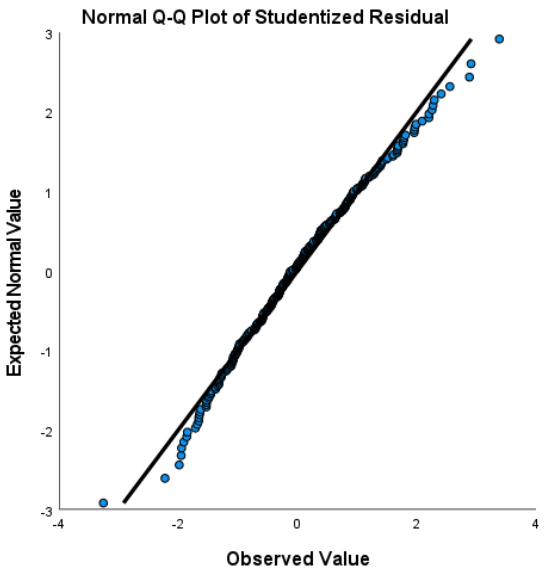
a. Dependent Variable: Time 2 Q-Life experience score

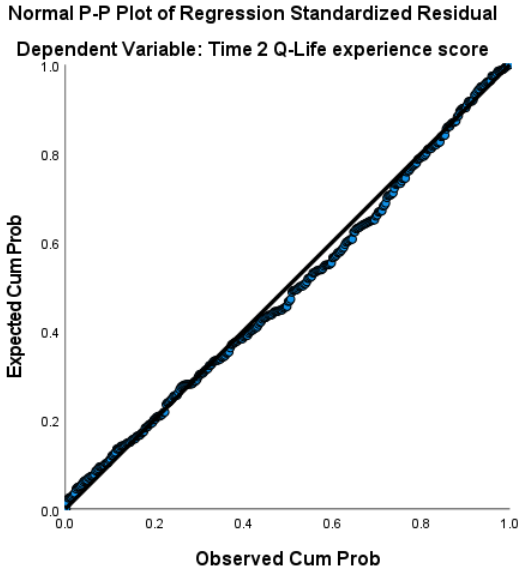
b. Predictors: (Constant), Time 1 Q-Life experience score

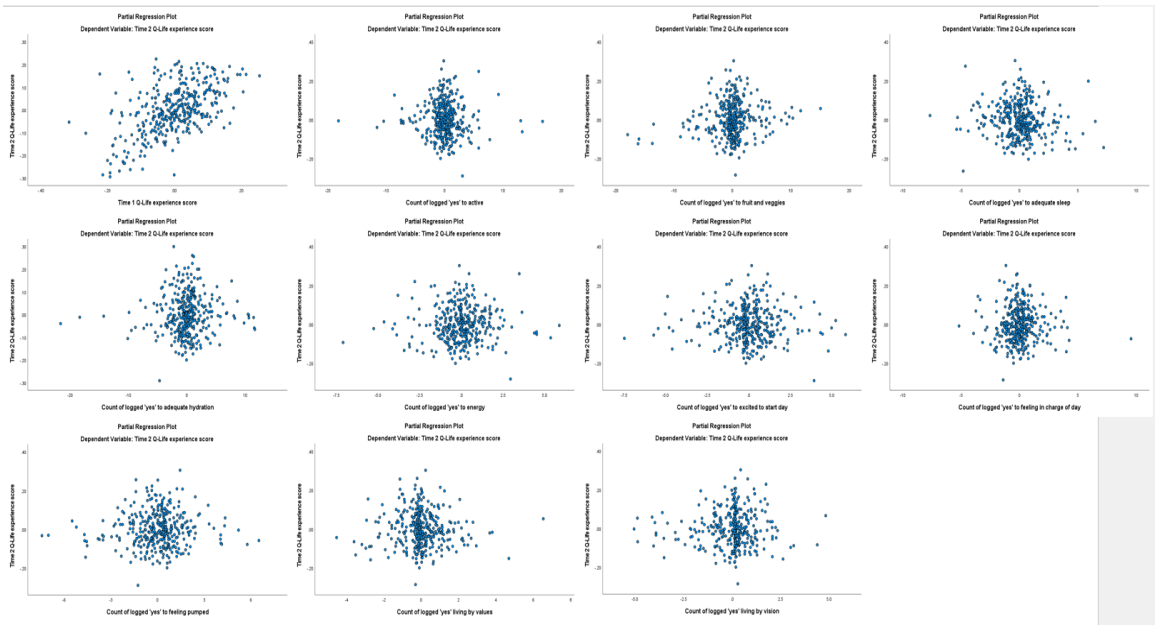
c. Predictors: (Constant), Time 1 Q-Life experience score, Count of logged 'yes' to adequate hydration, Count of logged 'yes' to fruit and veggies, Count of logged 'yes' to active, Count of logged 'yes' to adequate sleep

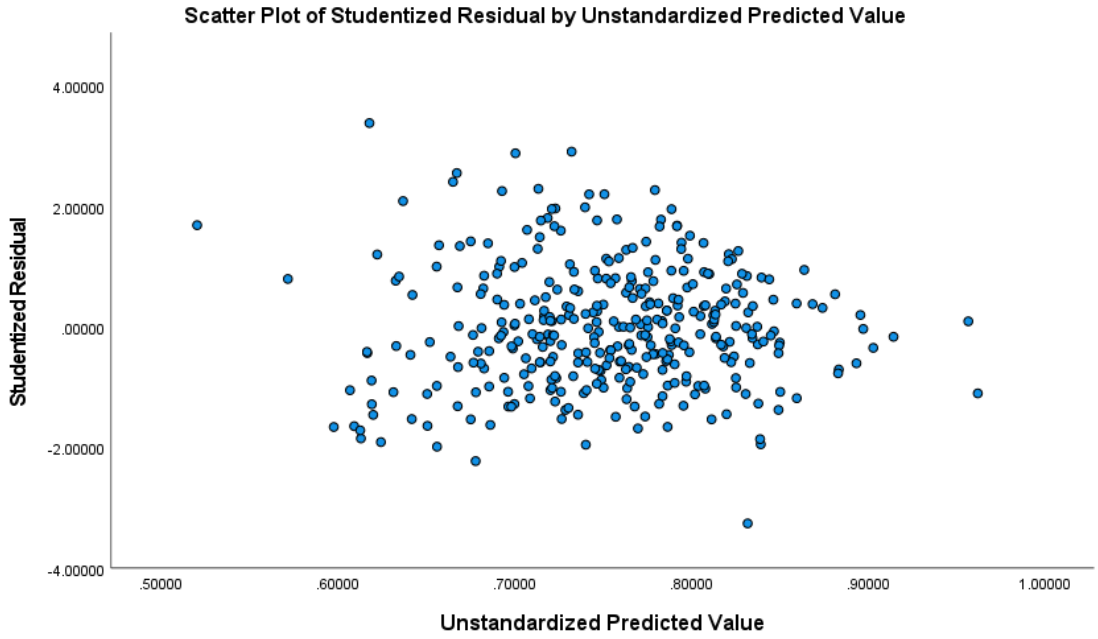
d. Predictors: (Constant), Time 1 Q-Life experience score, Count of logged 'yes' to adequate hydration, Count of logged 'yes' to fruit and veggies, Count of logged 'yes' to active, Count of logged 'yes' to adequate sleep, Count of logged 'yes' to feeling pumped, Count of logged 'yes' living by vision, Count of logged 'yes' to excited to start day, Count of logged 'yes' to energy, Count of logged 'yes' to feeling in charge of day, Count of logged 'yes' living by values


Histogram
Dependent Variable: Time 2 Q-Life experience score
Mean = -4.84E-15
Std. Dev. = 0.985
N = 360
Frequency
Regression Standardized Residual

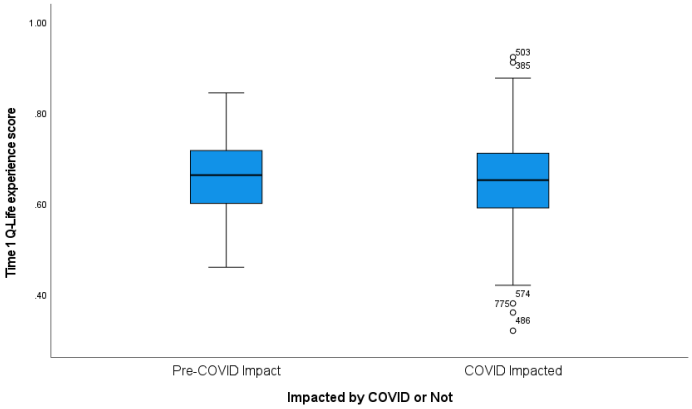

Normal Q-Q Plot of Studentized Residual
Expected Normal Value
Observed Value

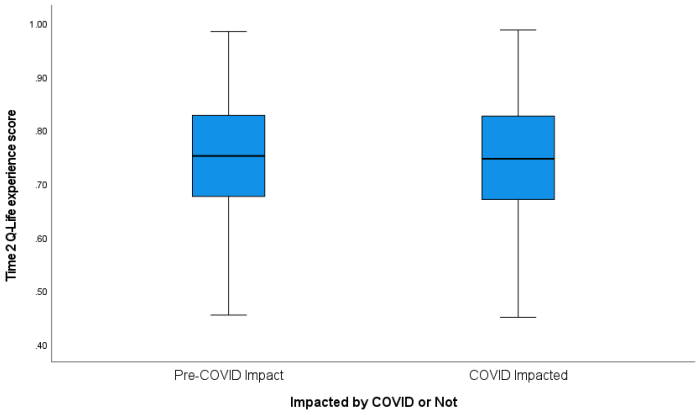

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Time 2 Q-Life experience score
Expected Cum Prob
Observed Cum Prob


Partial Regression Plot
Dependent Variable: Time 2 Q-Life experience score
Time 2 Q-Life experience score
Time 1 Q-Life experience score
Count of logged 'yes' to active
Count of logged 'yes' to fruit and veggies
Count of logged 'yes' to adequate sleep
Count of logged 'yes' to adequate hydration
Count of logged 'yes' to energy
Count of logged 'yes' to excited to start day
Count of logged 'yes' to feeling in charge of day
Count of logged 'yes' to feeling pumped
Count of logged 'yes' living by values
Count of logged 'yes' living by vision


Scatter Plot of Studentized Residual by Unstandardized Predicted Value
Studentized Residual
4.00000
2.00000
.00000
-2.00000
-4.00000
.50000
.60000
.70000
.80000
.90000
1.00000
Unstandardized Predicted Value

Appendix G: Comparing QES Across COVID-19 Impact and Time





Within-Subjects Factors

Measure: QES

Time	Dependent Variable
1	T1_QLifeExperienceScore
2	T2_QLifeExperienceScore

Box's Test of Equality of Covariance Matrices[a]

Box's M	9.625
F	3.191
df1	3
df2	28889853.331
Sig.	.023

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + COVID_Subgroup Within Subjects Design: Time

Between-Subjects Factors

		Value Label	N
Impacted by COVID or Not	1.00	Pre-COVID Impact	185
	2.00	COVID Impacted	239

Descriptive Statistics

	Impacted by COVID or Not	Mean	Std. Deviation	N
Time 1 Q-Life experience score	Pre-COVID Impact	.6572	.08557	185
	COVID Impacted	.6496	.10063	239
	Total	.6529	.09433	424
Time 2 Q-Life experience score	Pre-COVID Impact	.7467	.11534	185
	COVID Impacted	.7444	.10907	239
	Total	.7454	.11172	424

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.480	389.536[b]	1.000	422.000	<.001	.480
	Wilks' Lambda	.520	389.536[b]	1.000	422.000	<.001	.480
	Hotelling's Trace	.923	389.536[b]	1.000	422.000	<.001	.480
	Roy's Largest Root	.923	389.536[b]	1.000	422.000	<.001	.480
Time * COVID_Subgroup	Pillai's Trace	.001	.321[b]	1.000	422.000	.571	.001
	Wilks' Lambda	.999	.321[b]	1.000	422.000	.571	.001
	Hotelling's Trace	.001	.321[b]	1.000	422.000	.571	.001
	Roy's Largest Root	.001	.321[b]	1.000	422.000	.571	.001

a. Design: Intercept + COVID_Subgroup
Within Subjects Design: Time

b. Exact statistic

Tests of Within-Subjects Effects

Measure: QES

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	1.771	1	1.771	389.536	<.001	.480
	Greenhouse-Geisser	1.771	1.000	1.771	389.536	<.001	.480
	Huynh-Feldt	1.771	1.000	1.771	389.536	<.001	.480
	Lower-bound	1.771	1.000	1.771	389.536	<.001	.480
Time * COVID_Subgroup	Sphericity Assumed	.001	1	.001	.321	.571	.001
	Greenhouse-Geisser	.001	1.000	.001	.321	.571	.001
	Huynh-Feldt	.001	1.000	.001	.321	.571	.001
	Lower-bound	.001	1.000	.001	.321	.571	.001
Error(Time)	Sphericity Assumed	1.919	422	.005			
	Greenhouse-Geisser	1.919	422.000	.005			
	Huynh-Feldt	1.919	422.000	.005			
	Lower-bound	1.919	422.000	.005			

Tests of Within-Subjects Contrasts

Measure: QES

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Linear	1.771	1	1.771	389.536	<.001	.480
Time * COVID_Subgroup	Linear	.001	1	.001	.321	.571	.001
Error(Time)	Linear	1.919	422	.005			

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.
Time 1 Q-Life experience score	Based on Mean	2.035	1	422	.154
	Based on Median	2.050	1	422	.153
	Based on Median and with adjusted df	2.050	1	399.592	.153
	Based on trimmed mean	2.035	1	422	.154
Time 2 Q-Life experience score	Based on Mean	.759	1	422	.384
	Based on Median	.735	1	422	.392
	Based on Median and with adjusted df	.735	1	421.061	.392
	Based on trimmed mean	.744	1	422	.389

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + COVID_Subgroup
Within Subjects Design: Time

Tests of Between-Subjects Effects

Measure: QES

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	408.188	1	408.188	24200.786	.000	.983
COVID_Subgroup	.005	1	.005	.309	.578	.001
Error	7.118	422	.017			

Estimated Marginal Means for QES by COVID-19 Impact:

Estimates

Measure: QES

Impacted by COVID or Not	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Pre-COVID Impact	.702	.007	.689	.715
COVID Impacted	.697	.006	.685	.709

Pairwise Comparisons

Measure: QES

(I) Impacted by COVID or Not	(J) Impacted by COVID or Not	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	95% Confidence Interval for Difference[a] Upper Bound
Pre-COVID Impact	COVID Impacted	.005	.009	.578	-.013	.023
COVID Impacted	Pre-COVID Impact	-.005	.009	.578	-.023	.013

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

Measure: QES

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	.003	1	.003	.309	.578	.001
Error	3.559	422	.008			

The F tests the effect of Impacted by COVID or Not. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Estimated Marginal Means for QES by Time

Estimates

Measure: QES

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.653	.005	.644	.662
2	.746	.005	.735	.756

Pairwise Comparisons

Measure: QES

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.092*	.005	<.001	-.101	-.083
2	1	.092*	.005	<.001	.083	.101

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.480	389.536[a]	1.000	422.000	<.001	.480
Wilks' lambda	.520	389.536[a]	1.000	422.000	<.001	.480
Hotelling's trace	.923	389.536[a]	1.000	422.000	<.001	.480
Roy's largest root	.923	389.536[a]	1.000	422.000	<.001	.480

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Estimated Marginal Means by COVID-19 Impact and Time:

3. Impacted by COVID or Not * Time

Measure: QES

Impacted by COVID or Not	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Pre-COVID Impact	1	.657	.007	.644	.671
	2	.747	.008	.731	.763
COVID Impacted	1	.650	.006	.638	.662
	2	.744	.007	.730	.759

Appendix H: Participant Engagement Across Q-Life Versions

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Q-Life version	N	Percent	N	Percent	N	Percent
Sign in count	1	387	61.6%	241	38.4%	628	100.0%
	2	143	51.1%	137	48.9%	280	100.0%
	3	147	87.5%	21	12.5%	168	100.0%
Log entry count	1	387	61.6%	241	38.4%	628	100.0%
	2	143	51.1%	137	48.9%	280	100.0%
	3	147	87.5%	21	12.5%	168	100.0%
Percent program completion	1	387	61.6%	241	38.4%	628	100.0%
	2	143	51.1%	137	48.9%	280	100.0%
	3	147	87.5%	21	12.5%	168	100.0%

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Sign in count is the same across categories of Q-Life version.	Independent-Samples Kruskal-Wallis Test	<.001	Reject the null hypothesis.
2	The distribution of Log entry count is the same across categories of Q-Life version.	Independent-Samples Kruskal-Wallis Test	.003	Reject the null hypothesis.
3	The distribution of Percent program completion is the same across categories of Q-Life version.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

a. The significance level is .050.

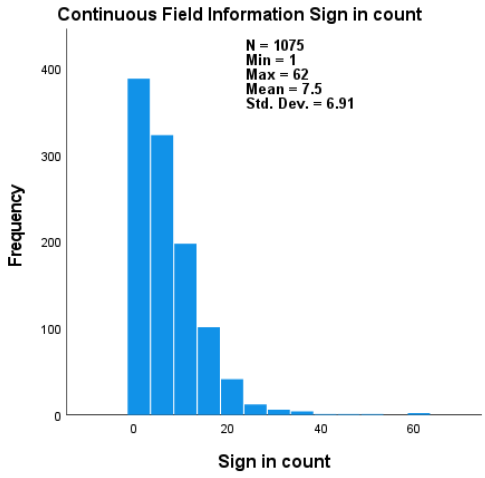
b. Asymptotic significance is displayed.

Sign-in Entry Count:

Independent-Samples Kruskal-Wallis Test Summary

Total N	1075
Test Statistic	32.425[a]
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	<.001

a. The test statistic is adjusted for ties.



Pairwise Comparisons of Q-Life version

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
2-1	20.070	22.236	.903	.367	1.000
2-3	-159.967	30.191	-5.299	<.001	.000
1-3	-139.897	26.876	-5.205	<.001	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

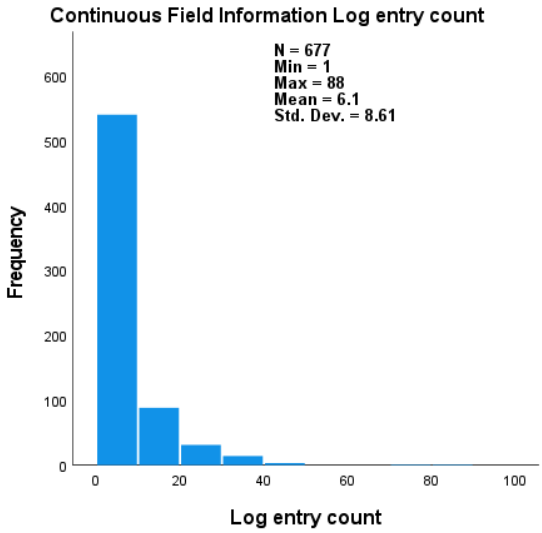
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Log Entry Count:

Independent-Samples Kruskal-Wallis Test Summary

Total N	677
Test Statistic	11.376[a]
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	.003

a. The test statistic is adjusted for ties.



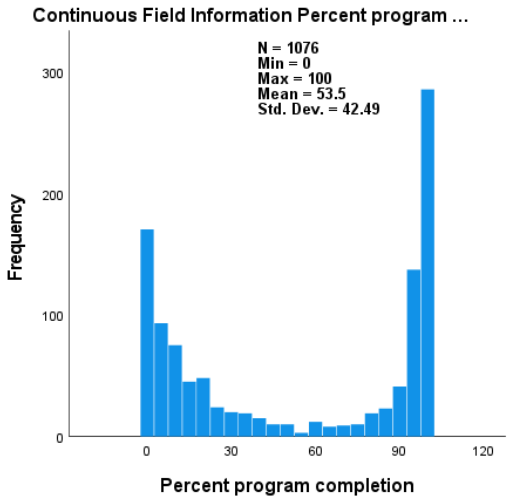
Pairwise Comparisons of Q-Life version

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
2-1	7.348	18.715	.393	.695	1.000
2-3	-65.084	22.462	-2.898	.004	.011
1-3	-57.736	18.528	-3.116	.002	.005

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Percent Program Completion:



Independent-Samples Kruskal-Wallis Test Summary

Total N	1076
Test Statistic	75.613[a]
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	.000

a. The test statistic is adjusted for ties.

Pairwise Comparisons of Q-Life version

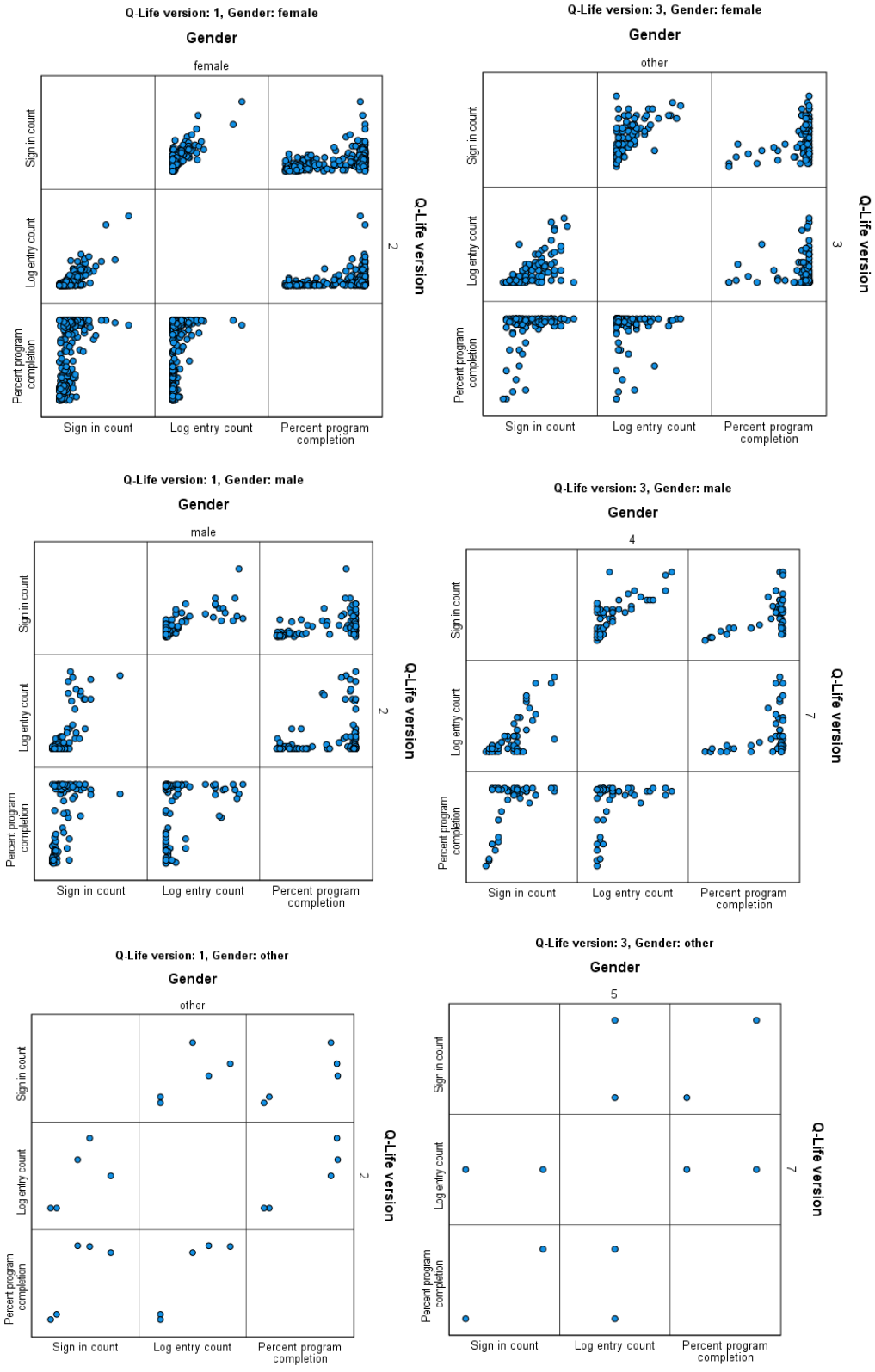
Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
2-1	10.917	22.271	.490	.624	1.000
2-3	-233.533	30.246	-7.721	<.001	.000
1-3	-222.617	26.920	-8.269	.000	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Appendix I: Engagement by Gender and Q-Life Version



Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.790**	.613**
	Sig. (2-tailed)		<.001	<.001
	N	488	296	488
Log entry count	Pearson Correlation	.790**	1	.315**
	Sig. (2-tailed)	<.001		<.001
	N	296	296	296
Percent program completion	Pearson Correlation	.613**	.315**	1
	Sig. (2-tailed)	<.001	<.001	
	N	488	296	489

**. Correlation is significant at the 0.01 level (2-tailed).

a. Q-Life version = 1, Gender = female

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.761**	.540**
	Sig. (2-tailed)		<.001	<.001
	N	128	83	128
Log entry count	Pearson Correlation	.761**	1	.336**
	Sig. (2-tailed)	<.001		.002
	N	83	83	83
Percent program completion	Pearson Correlation	.540**	.336**	1
	Sig. (2-tailed)	<.001	.002	
	N	128	83	128

**. Correlation is significant at the 0.01 level (2-tailed).

a. Q-Life version = 1, Gender = male

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.666	.890**
	Sig. (2-tailed)		.220	.007
	N	7	5	7
Log entry count	Pearson Correlation	.666	1	.919*
	Sig. (2-tailed)	.220		.027
	N	5	5	5
Percent program completion	Pearson Correlation	.890**	.919*	1
	Sig. (2-tailed)	.007	.027	
	N	7	5	7

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Q-Life version = 1, Gender = other

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.619**	.393**
	Sig. (2-tailed)		<.001	<.001
	N	103	96	103
Log entry count	Pearson Correlation	.619**	1	.118
	Sig. (2-tailed)	<.001		.251
	N	96	96	96
Percent program completion	Pearson Correlation	.393**	.118	1
	Sig. (2-tailed)	<.001	.251	
	N	103	96	103

**. Correlation is significant at the 0.01 level (2-tailed).

a. Q-Life version = 3, Gender = female

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.739**	.630**
	Sig. (2-tailed)		<.001	<.001
	N	60	49	60
Log entry count	Pearson Correlation	.739**	1	.371**
	Sig. (2-tailed)	<.001		.009
	N	49	49	49
Percent program completion	Pearson Correlation	.630**	.371**	1
	Sig. (2-tailed)	<.001	.009	
	N	60	49	60

**. Correlation is significant at the 0.01 level (2-tailed).

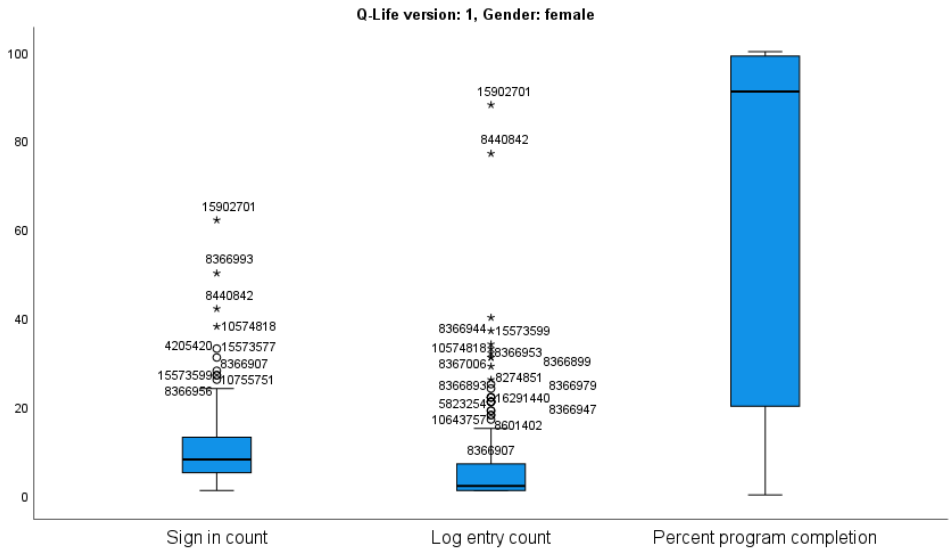
a. Q-Life version = 3, Gender = male

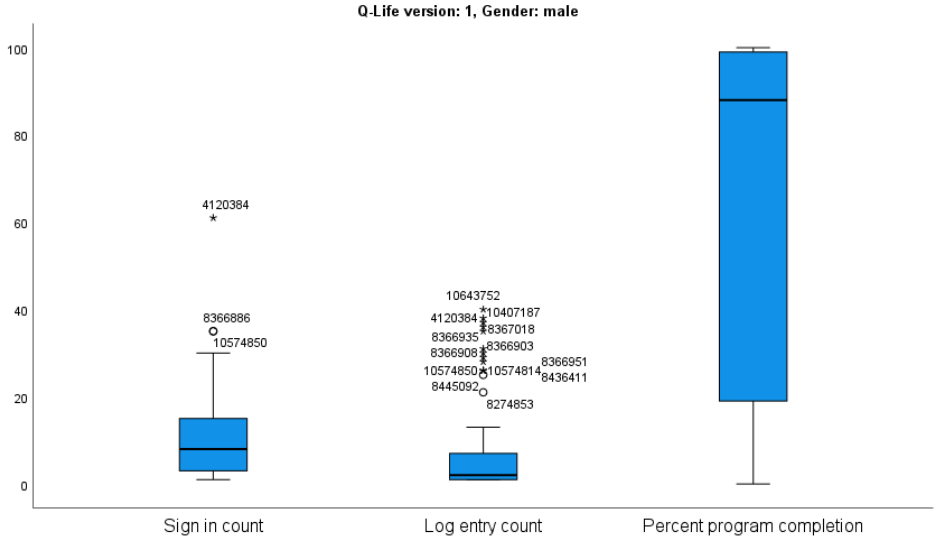
Correlations[a]

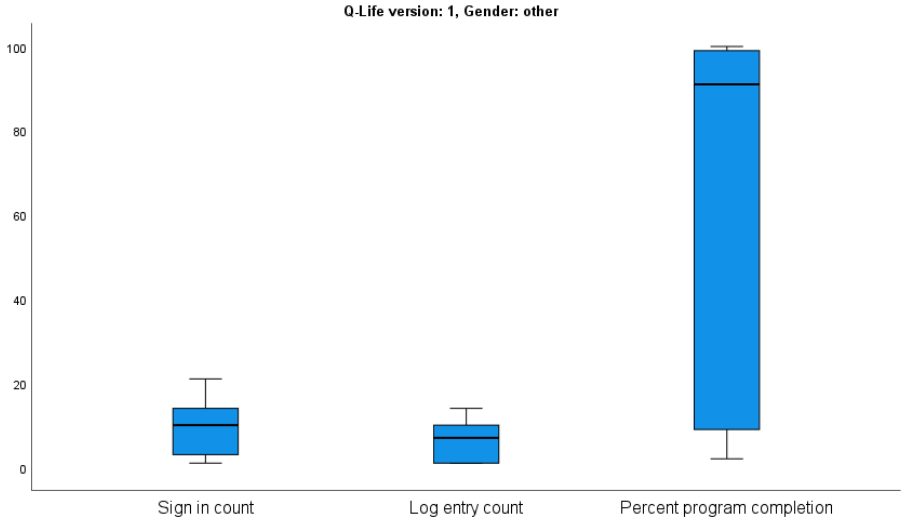
		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.[b]	.536
	Sig. (2-tailed)		.	.464
	N	4	2	4
Log entry count	Pearson Correlation	.[b]	.[b]	.[b]
	Sig. (2-tailed)	.		.
	N	2	2	2
Percent program completion	Pearson Correlation	.536	.[b]	1
	Sig. (2-tailed)	.464	.	
	N	4	2	4

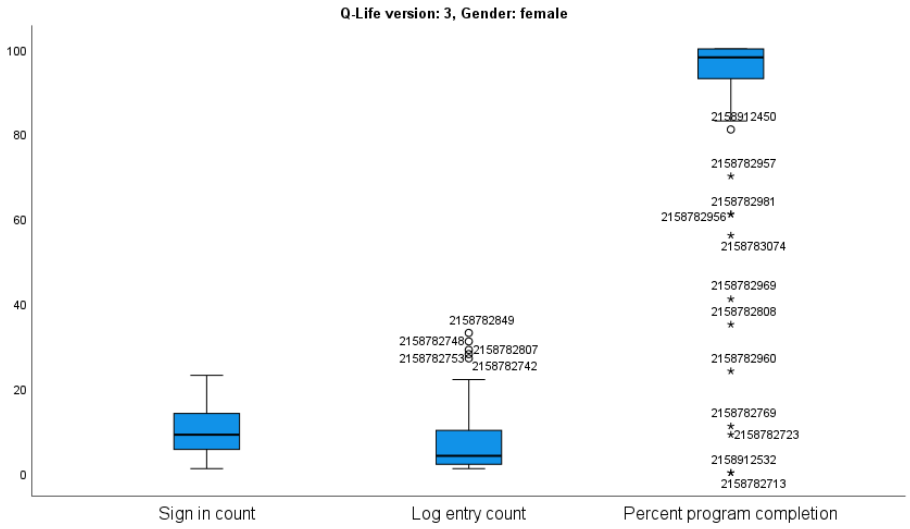
a. Q-Life version = 3, Gender = other

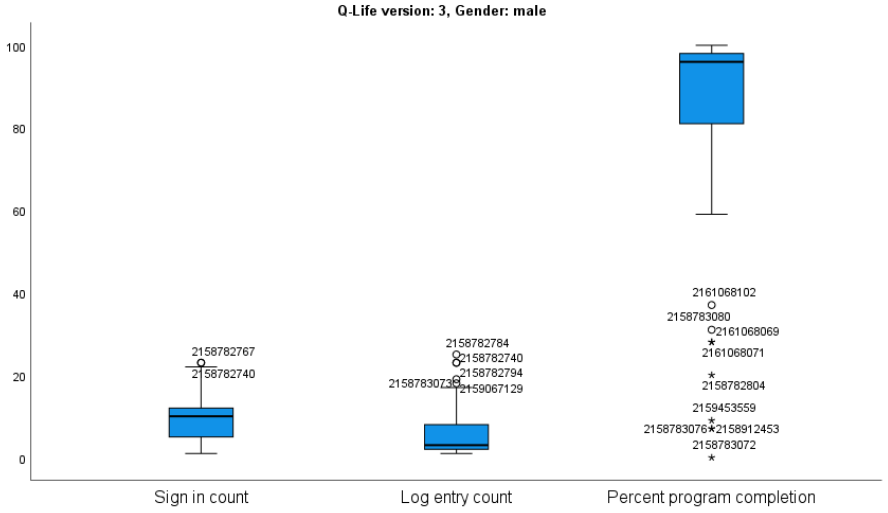
b. Cannot be computed because at least one of the variables is constant.

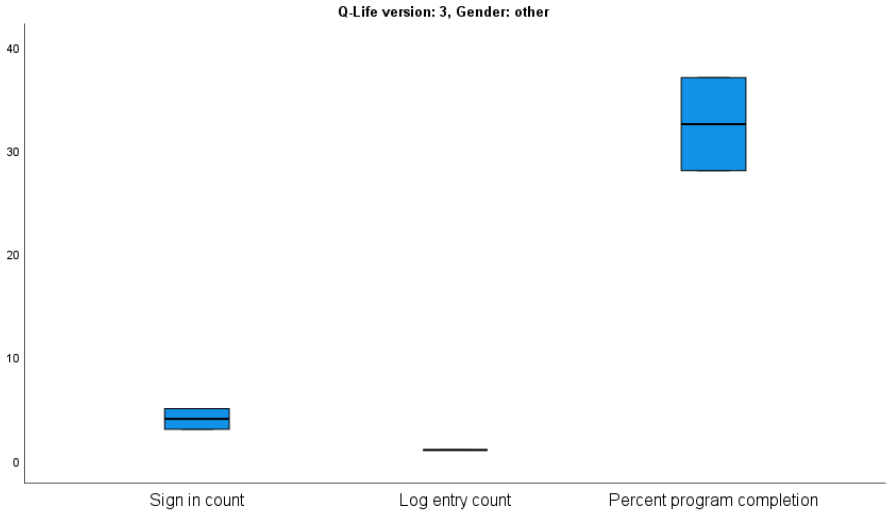

Q-Life version: 1, Gender: female
100
80
60
40
20
0
15902701
8440842
15902701
8366993
8440842
10574818
4205420
15573577
8366907
15573599
10755751
8366956
8366944
15573599
10574818
8366953
8367006
8366899
8366893
8274851
8366979
16291440
8366947
8601402
8366907
Sign in count
Log entry count
Percent program completion


Q-Life version: 1, Gender: male
100
80
60
40
20
0
4120384
8366886
10574850
10643752
4120384
10407187
8367018
8366935
8366903
8366908
8366951
10574850
10574814
8436411
8445092
8274853
Sign in count
Log entry count
Percent program completion


Q-Life version: 1, Gender: other
100
80
60
40
20
0
Sign in count
Log entry count
Percent program completion


Q-Life version: 3, Gender: female
100
80
60
40
20
0
2158912450
2158782957
2158782981
2158782956
2158783074
2158782969
2158782808
2158782960
2158782769
2158782723
2158912532
2158782713
2158782849
2158782748
2158782807
2158782742
Sign in count
Log entry count
Percent program completion


Q-Life version: 3, Gender: male
100
80
60
40
20
0
2161068102
2158783080
2161068069
2161068071
2158782804
2159453559
2158783076
2158912453
2158783072
2158782767
2158782740
2158782784
2158782740
2158782794
2159067129
Sign in count
Log entry count
Percent program completion


Q-Life version: 3, Gender: other
40
30
20
10
0
Sign in count
Log entry count
Percent program completion

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.132	296	<.001	.819	296	<.001
Log entry count	.301	296	<.001	.542	296	<.001
Percent program completion	.255	296	<.001	.764	296	<.001

a. Q-Life version = 1, Gender = female

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.168	83	<.001	.809	83	<.001
Log entry count	.312	83	<.001	.638	83	<.001
Percent program completion	.246	83	<.001	.780	83	<.001

a. Q-Life version = 1, Gender = male

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.197	5	.200*	.953	5	.760
Log entry count	.238	5	.200*	.905	5	.437
Percent program completion	.331	5	.078	.751	5	.030

*. This is a lower bound of the true significance.

a. Q-Life version = 1, Gender = other

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.116	96	.003	.961	96	.006
Log entry count	.206	96	<.001	.783	96	<.001
Percent program completion	.351	96	<.001	.505	96	<.001

a. Q-Life version = 3, Gender = female

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.115	49	.118	.943	49	.020
Log entry count	.238	49	<.001	.782	49	<.001
Percent program completion	.338	49	<.001	.669	49	<.001

a. Q-Life version = 3, Gender = male

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]		
	Statistic	df	Sig.
Sign in count	.260	2	.
Log entry count	.	2	.
Percent program completion	.260	2	.

a. Q-Life version = 3, Gender = other

b. Lilliefors Significance Correction

Multivariate Tests[a]

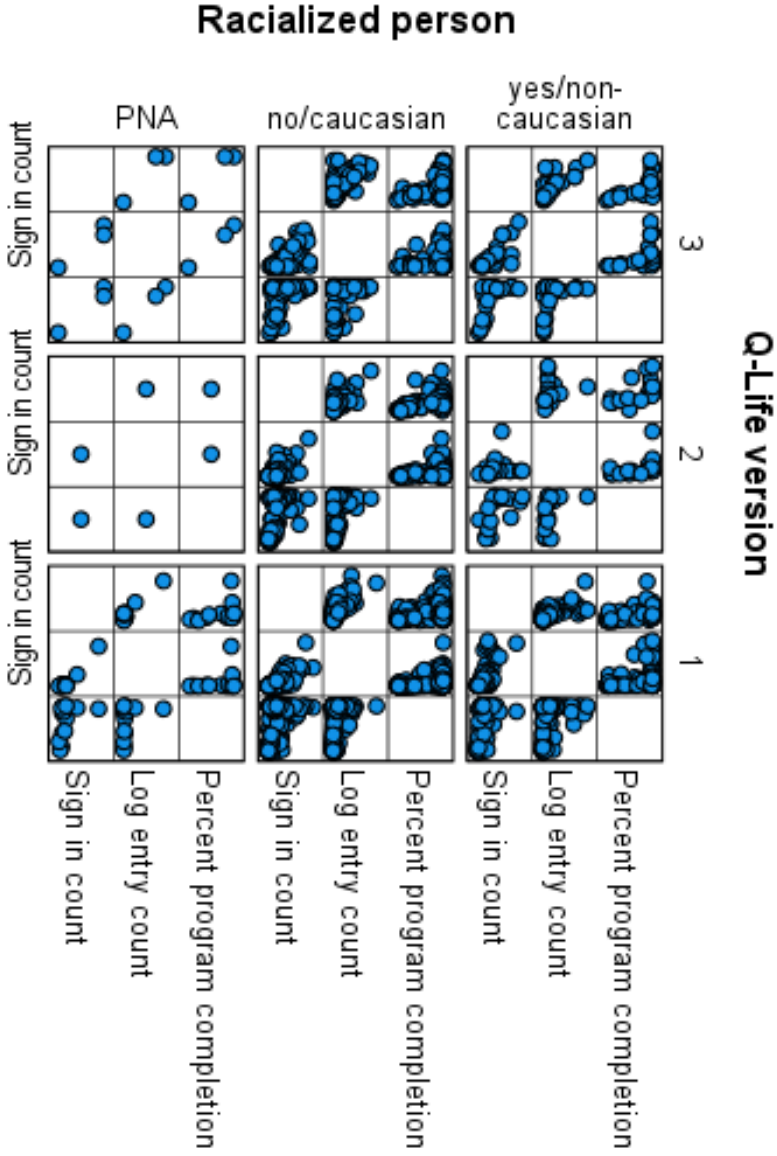
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.164	43.524[b]	3.000	665.000	<.001	.164
	Wilks' Lambda	.836	43.524[b]	3.000	665.000	<.001	.164
	Hotelling's Trace	.196	43.524[b]	3.000	665.000	<.001	.164
	Roy's Largest Root	.196	43.524[b]	3.000	665.000	<.001	.164
Gender	Pillai's Trace	.019	1.436	9.000	2001.000	.167	.006
	Wilks' Lambda	.981	1.436	9.000	1618.586	.167	.006
	Hotelling's Trace	.019	1.435	9.000	1991.000	.167	.006
	Roy's Largest Root	.014	3.029[c]	3.000	667.000	.029	.013
QLifeVersion	Pillai's Trace	.006	.618	6.000	1332.000	.716	.003
	Wilks' Lambda	.994	.617[b]	6.000	1330.000	.717	.003
	Hotelling's Trace	.006	.616	6.000	1328.000	.718	.003
	Roy's Largest Root	.004	.790[c]	3.000	666.000	.500	.004
Gender * QLifeVersion	Pillai's Trace	.008	.455	12.000	2001.000	.941	.003
	Wilks' Lambda	.992	.454	12.000	1759.716	.941	.003
	Hotelling's Trace	.008	.454	12.000	1991.000	.941	.003
	Roy's Largest Root	.006	1.081[c]	4.000	667.000	.365	.006

a. Design: Intercept + Gender + QLifeVersion + Gender * QLifeVersion

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Appendix J: Engagement by Racial Identity and Q-Life Version



Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.777**	.614**
	Sig. (2-tailed)		<.001	<.001
	N	408	258	408
Log entry count	Pearson Correlation	.777**	1	.343**
	Sig. (2-tailed)	<.001		<.001
	N	258	258	258
Percent program completion	Pearson Correlation	.614**	.343**	1
	Sig. (2-tailed)	<.001	<.001	
	N	408	258	409

**. Correlation is significant at the 0.01 level (2-tailed).

a. Racialized person = no/caucasian, Q-Life version = 1

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.638**	.466**
	Sig. (2-tailed)		<.001	<.001
	N	130	117	130
Log entry count	Pearson Correlation	.638**	1	.160
	Sig. (2-tailed)	<.001		.085
	N	117	117	117
Percent program completion	Pearson Correlation	.466**	.160	1
	Sig. (2-tailed)	<.001	.085	
	N	130	117	130

**. Correlation is significant at the 0.01 level (2-tailed).

a. Racialized person = no/caucasian, Q-Life version = 3

Correlations[a]

		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.638**	.466**
	Sig. (2-tailed)		<.001	<.001
	N	130	117	130
Log entry count	Pearson Correlation	.638**	1	.160
	Sig. (2-tailed)	<.001		.085
	N	117	117	117
Percent program completion	Pearson Correlation	.466**	.160	1
	Sig. (2-tailed)	<.001	.085	
	N	130	117	130

**. Correlation is significant at the 0.01 level (2-tailed).

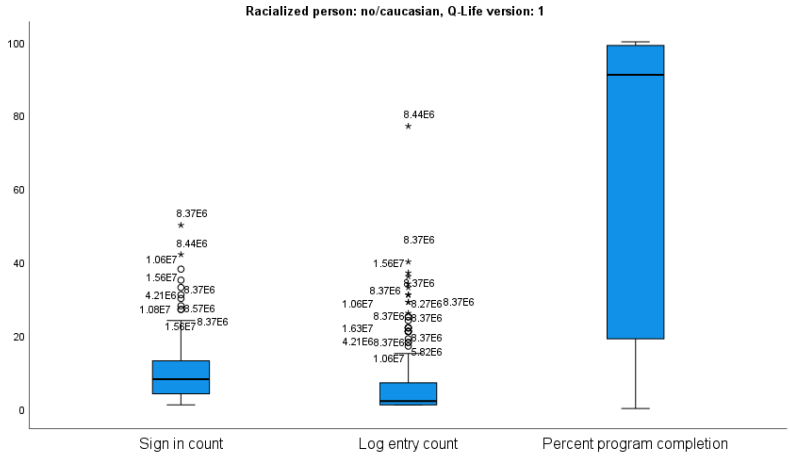
a. Racialized person = no/caucasian, Q-Life version = 3

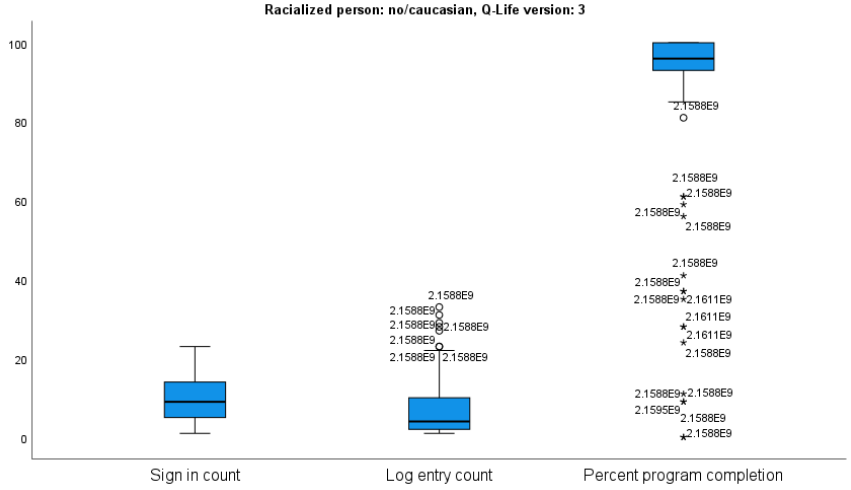
Correlations[a]

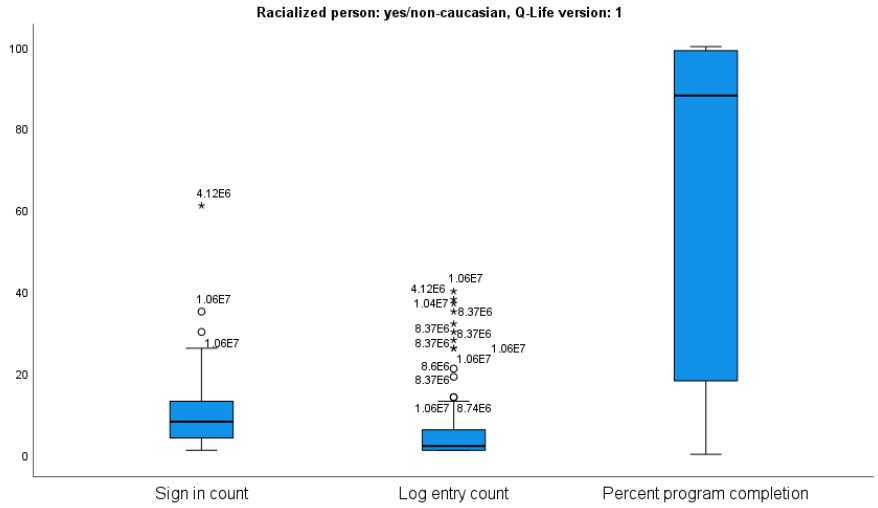
		Sign in count	Log entry count	Percent program completion
Sign in count	Pearson Correlation	1	.689**	.599**
	Sig. (2-tailed)		<.001	<.001
	N	199	115	199
Log entry count	Pearson Correlation	.689**	1	.330**
	Sig. (2-tailed)	<.001		<.001
	N	115	115	115
Percent program completion	Pearson Correlation	.599**	.330**	1
	Sig. (2-tailed)	<.001	<.001	
	N	199	115	199

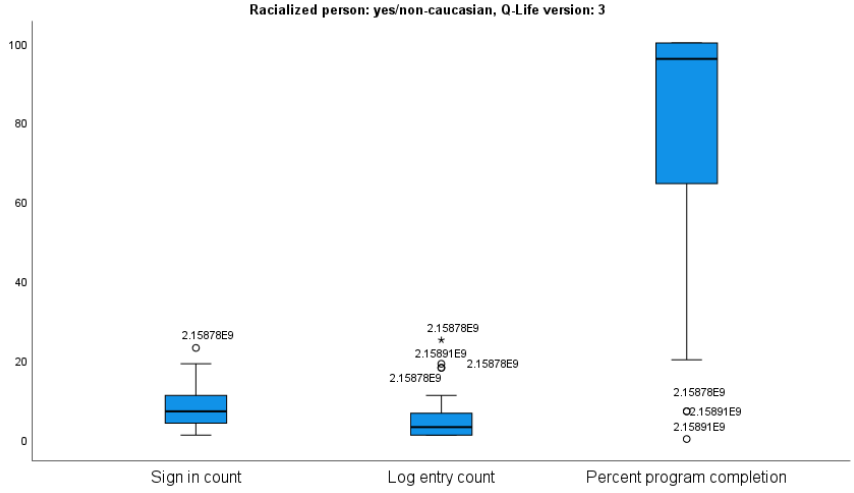
**. Correlation is significant at the 0.01 level (2-tailed).

a. Racialized person = yes/non-caucasian, Q-Life version = 1


Racialized person: no/caucasian, Q-Life version: 1
100
80
60
40
20
0
Sign in count
Log entry count
Percent program completion


Racialized person: no/caucasian, Q-Life version: 3
100
80
60
40
20
0
Sign in count
Log entry count
Percent program completion


Racialized person: yes/non-caucasian, Q-Life version: 1
100
80
60
40
20
0
4.12E6
1.06E7
1.06E7
1.06E7
4.12E6
1.04E7
8.37E6
8.37E6
8.37E6
8.37E6
1.06E7
1.06E7
8.6E6
8.37E6
1.06E7
8.74E6
Sign in count
Log entry count
Percent program completion


Racialized person: yes/non-caucasian, Q-Life version: 3
100
80
60
40
20
0
2.15878E9
2.15878E9
2.15891E9
2.15878E9
2.15878E9
2.15878E9
2.15891E9
2.15891E9
Sign in count
Log entry count
Percent program completion

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.352	14	<.001	.632	14	<.001
Log entry count	.444	14	<.001	.444	14	<.001
Percent program completion	.256	14	.014	.819	14	.009

a. Racialized person = PNA, Q-Life version = 1

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.385	3	.	.750	3	.000
Log entry count	.301	3	.	.912	3	.424
Percent program completion	.314	3	.	.893	3	.363

a. Racialized person = PNA, Q-Life version = 3

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.138	258	<.001	.863	258	<.001
Log entry count	.279	258	<.001	.624	258	<.001
Percent program completion	.258	258	<.001	.765	258	<.001

a. Racialized person = no/caucasian, Q-Life version = 1

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.108	117	.002	.963	117	.003
Log entry count	.209	117	<.001	.779	117	<.001
Percent program completion	.360	117	<.001	.545	117	<.001

a. Racialized person = no/caucasian, Q-Life version = 3

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.142	115	<.001	.804	115	<.001
Log entry count	.290	115	<.001	.600	115	<.001
Percent program completion	.246	115	<.001	.774	115	<.001

a. Racialized person = yes/non-caucasian, Q-Life version = 1

b. Lilliefors Significance Correction

Tests of Normality[a]

	Kolmogorov-Smirnov[b]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Sign in count	.173	27	.037	.902	27	.015
Log entry count	.239	27	<.001	.750	27	<.001
Percent program completion	.302	27	<.001	.713	27	<.001

a. Racialized person = yes/non-caucasian, Q-Life version = 3

b. Lilliefors Significance Correction

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.
Sign in count	Based on Mean	2.663	7	668	.010
	Based on Median	1.571	7	668	.141
	Based on Median and with adjusted df	1.571	7	370.443	.143
	Based on trimmed mean	1.922	7	668	.064
Log entry count	Based on Mean	4.570	7	668	<.001
	Based on Median	1.155	7	668	.327
	Based on Median and with adjusted df	1.155	7	324.624	.328
	Based on trimmed mean	2.312	7	668	.025
Percent program completion	Based on Mean	23.087	7	668	<.001
	Based on Median	6.161	7	668	<.001
	Based on Median and with adjusted df	6.161	7	633.428	<.001
	Based on trimmed mean	23.434	7	668	<.001

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + RacializedPerson + QLifeVersion + RacializedPerson * QLifeVersion

Multivariate Tests[a]

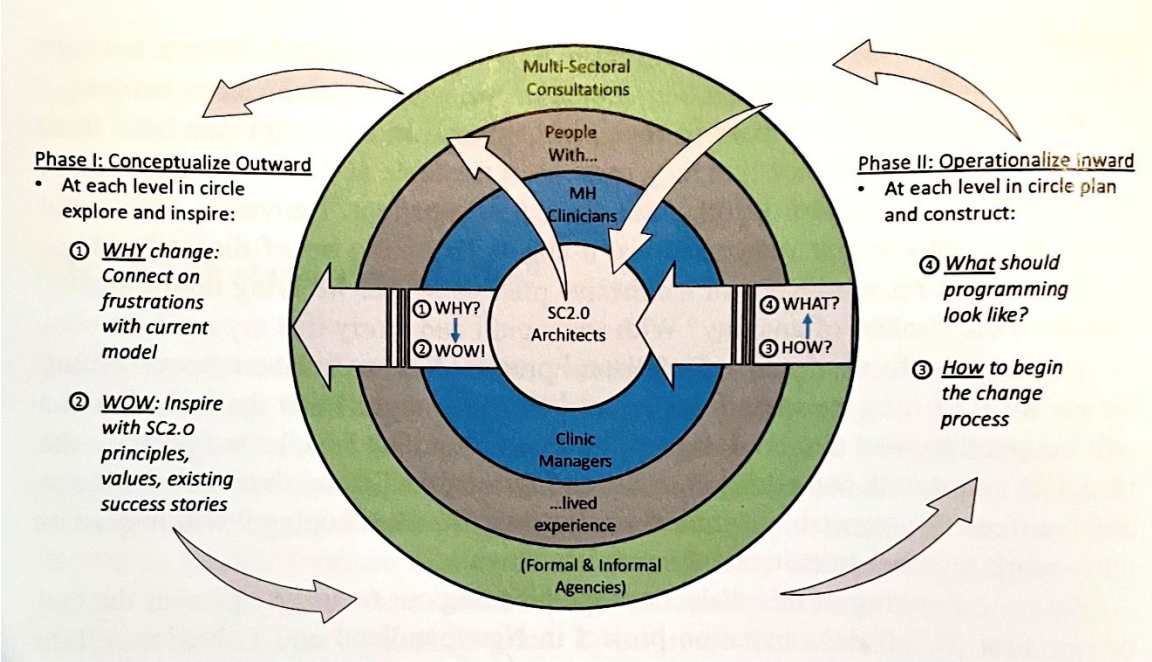
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.256	76.520[b]	3.000	666.000	<.001	.256
	Wilks' Lambda	.744	76.520[b]	3.000	666.000	<.001	.256
	Hotelling's Trace	.345	76.520[b]	3.000	666.000	<.001	.256
	Roy's Largest Root	.345	76.520[b]	3.000	666.000	<.001	.256
RacializedPerson	Pillai's Trace	.005	.590	6.000	1334.000	.738	.003
	Wilks' Lambda	.995	.590[b]	6.000	1332.000	.739	.003
	Hotelling's Trace	.005	.589	6.000	1330.000	.739	.003
	Roy's Largest Root	.005	1.053[c]	3.000	667.000	.368	.005
QLifeVersion	Pillai's Trace	.019	2.078	6.000	1334.000	.053	.009
	Wilks' Lambda	.982	2.079[b]	6.000	1332.000	.053	.009
	Hotelling's Trace	.019	2.081	6.000	1330.000	.053	.009
	Roy's Largest Root	.016	3.550[c]	3.000	667.000	.014	.016
RacializedPerson * QLifeVersion	Pillai's Trace	.007	.396	12.000	2004.000	.966	.002
	Wilks' Lambda	.993	.395	12.000	1762.362	.966	.002
	Hotelling's Trace	.007	.394	12.000	1994.000	.966	.002
	Roy's Largest Root	.004	.645[c]	4.000	668.000	.630	.004

a. Design: Intercept + RacializedPerson + QLifeVersion + RacializedPerson * QLifeVersion

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Appendix K: Distributive Design Cycle



Cornish, P. (2021). *Stepped Care 2.0: A Paradigm Shift in Mental Health* (1st ed. 2020 edition). Springer Nature.