Behavioural Validation of Autonomic:
A Large-Scale Evaluation of a Neuroscience-Informed Digital Behaviour Change Platform

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Abstract

Digital behaviour change interventions offer a scalable approach to supporting university-student well-being, but relatively few platforms have been evaluated using real-world engagement data. This nonrandomized study examined changes in five self-reported outcomes among 376 undergraduate users of Autonomic, a neuroscience-informed digital behaviour change platform, and 50 independently recruited undergraduate students who received no intervention. Autonomic users had completed at least 10 sessions and engaged during at least 20% of each week across a 10-week period. Ratings of stress, sleep, energy, mood, and focus were collected before and after the period on 1–10 sliders and linearly rescaled to 0–100. Among Autonomic users, stress decreased by 17.6%, whereas sleep, energy, mood, and focus increased by 29.1%, 10.5%, 24.9%, and 13.1%, respectively (all ps < .001; |d|s = 0.20–0.59). The nonintervention comparison group showed no statistically significant pre–post change on any outcome. These findings indicate that sustained engagement with Autonomic was associated with small-to-moderate improvements across multiple dimensions of self-reported student functioning. Further, the results here suggest that Autonomic is a potential tool for improving overall human performance.

Keywords: digital behaviour change, university students, stress, sleep, well-being, digital health

Introduction

Behaviour change is fundamental to improving health, well-being, and human performance because many factors that influence physical and psychological functioning are shaped by daily behaviour. Obtaining sufficient sleep, managing stress, maintaining physical activity, and sustaining healthy routines influence cognitive performance, mental health, academic success, and quality of life (Michie et al., 2011; Spring et al., 2013). Behaviour change interventions therefore occupy a central role in health promotion. Contemporary interventions commonly incorporate self-monitoring, goal setting, personalized feedback, prompts, and habit-formation strategies to support sustained change across health domains (Abraham & Michie, 2008; Michie et al., 2013).

University students are a particularly relevant population for such interventions. The transition to post-secondary education brings increased academic demands, independence, financial pressure, and disruption of established routines, often alongside poorer sleep, elevated stress, reduced energy, impaired concentration, and diminished psychological well-being (Arnett, 2000; Bewick et al., 2010; Deliens et al., 2014). These challenges are associated with poorer academic performance and increased vulnerability to mental-health concerns (Richardson et al., 2012). Moreover, behaviours established during emerging adulthood may persist later in life, making the university years an important period for developing sustainable healthy habits (Nelson et al., 2008).

Digital interventions offer a scalable way to address these challenges. Smartphones and web-based technologies can deliver coaching, self-monitoring, goal setting, and timely feedback with fewer resources than conventional face-to-face programs (Murray et al., 2016). Reviews and meta-analyses suggest that digital interventions can improve health behaviour, sleep, stress, and psychological well-being, particularly when they use established behaviour-change techniques and individualized feedback (Firth et al., 2017; Taylor et al., 2024; Webb et al., 2010). At the same time, effectiveness depends on engagement, implementation, and the

population reached, and real-world evaluations are needed alongside controlled efficacy trials (Murray et al., 2016; Taylor et al., 2024).

Together, this literature suggests that student well-being may be especially responsive to scalable interventions that combine behaviour-change techniques with frequent self-monitoring and personalized feedback. However, evidence from real-world platform engagement remains limited, particularly for multidomain interventions that target stress, sleep, energy, mood, and focus simultaneously.

Autonomic is a neuroscience-informed digital behaviour change platform designed to support five interconnected domains relevant to student well-being and performance: stress, sleep, energy, mood, and focus. Rather than targeting a single behaviour, it delivers brief personalized coaching and daily check-ins intended to foster self-monitoring, self-regulation, and sustainable habit formation. The present study evaluated whether undergraduate students who demonstrated sustained engagement with Autonomic showed pre–post changes in these five domains over a 10-week period. Their outcomes were considered alongside those of an independently recruited, non-intervention comparison group assessed over the same interval. We predicted improvement across all five domains among Autonomic users and little or no change in the comparison group.

Methods

Design and Participants

The study used a nonrandomized, pre–post design with independently recruited groups. The Autonomic cohort comprised 376 undergraduate students who were existing platform users at the University of Victoria, McGill University, the University of British Columbia–Okanagan, Okanagan College, and Conestoga College. Deidentified platform data were provided to the University of Victoria research team for secondary analysis. Eligibility for analysis required completion of at least 10 Autonomic sessions and engagement during at least 20% of each week across the 10-week period. All 376 users satisfied these criteria and had complete pre- and post-

assessment data. The cohort included 200 men and 176 women; age was not collected but all participants were university undergraduate students. Users received free access to Autonomic but no other compensation.

The comparison group comprised 50 undergraduate volunteers recruited through REACH BC, an online provincial platform that connects British Columbia residents with research opportunities. Eligibility criteria included being a university undergraduate student. Age and gender data were not collected for this group. Participants continued their usual activities for 10 weeks, received no intervention or compensation, were not informed about Autonomic, and completed the same outcome assessments at baseline and follow-up.

The study, including recruitment of the REACH BC comparison group and secondary analysis of the deidentified Autonomic platform data, was approved by the University of Victoria Human Research Ethics Board (protocol 25-0254). Autonomic users acknowledged the platform's terms governing the use of aggregated or deidentified information for platform improvement and scientific research. Comparison participants provided informed consent under the approved University of Victoria protocol. The study was conducted in accordance with the Declaration of Helsinki.

Autonomic Platform and Procedure

Autonomic is a web-based digital health and performance platform that provides brief, personalized, neuroscience-informed coaching. Daily check-ins and micro-coaching sessions help users monitor sleep quality, stress, mood, energy, and focus and provide individualized guidance intended to support habit formation, self-regulation, and day-to-day functioning. Sessions were designed to require approximately three minutes. Autonomic users completed the five outcome ratings at the start of the 10-week period and again at its conclusion. Comparison participants completed the same ratings at baseline and after 10 weeks.

Measures

Five proprietary single-item ratings were administered. Sleep was assessed with "Rate your sleep quality last night," accompanied by guidance referring to how restful and uninterrupted sleep was and how refreshed the user felt upon waking. Stress was assessed with "Rate your stress level," referring to feeling overwhelmed or under pressure. Energy was assessed with "Rate your energy level," referring to available energy for thinking, focusing, and getting things done. Focus was assessed with "Rate your focus level," referring to the ability to work without distraction. Mood was assessed with "Rate your mood level," referring to the user's overall state of mind or feeling. All responses were entered on continuous 1–10 sliders visually anchored as low, medium, and high. Values were multiplied by 10 for analysis and presentation on a 0–100 metric. The same items and scoring procedure were used at both assessments and in both groups.

Statistical Analysis

For each outcome, pre- and post-assessment scores were compared within each group using paired-samples t tests. Statistical assumptions were assessed and met. The familywise alpha level was set at .05, and standardized mean-change effects are reported as Cohen's d. Percentage change was calculated relative to the pre-assessment value. Figure 1 displays 95% within-subject confidence intervals calculated using the method described by Masson and Loftus (2003). Analyses were conducted in JASP.

Results

Comparison Group

Results are presented in two steps. First, we report changes in the nonintervention comparison group to establish whether similar pre–post shifts occurred without exposure to Autonomic. Second, we report changes among engaged Autonomic users across the same five outcome domains.

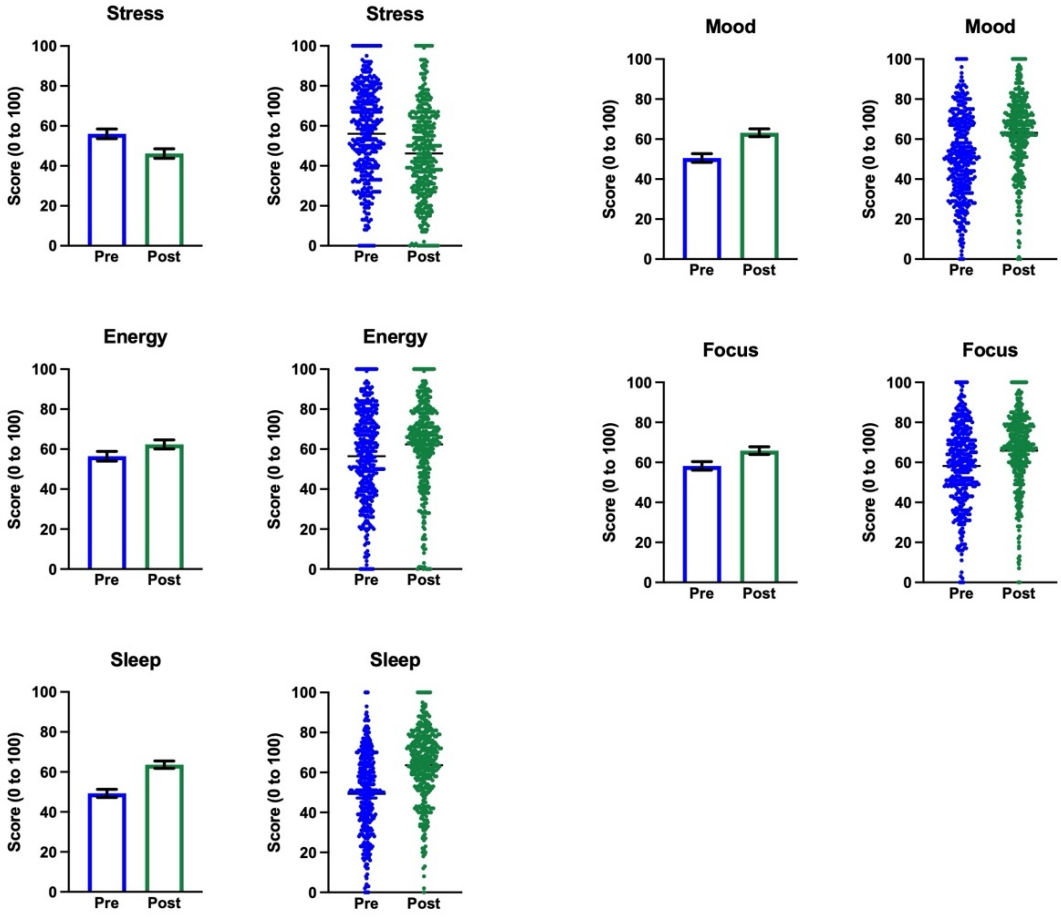
The nonintervention comparison group showed no statistically significant pre–post change in stress, sleep, energy, mood, or focus (all ps > .05).

Autonomic Group

Autonomic users improved significantly on all five outcomes. Stress decreased by 17.6%, $t(375) = 6.79$, $p < .001$, $d = -0.35$. Sleep increased by 29.1%, $t(375) = 11.35$, $p < .001$, $d = 0.59$. Energy increased by 10.5%, $t(375) = 3.92$, $p < .001$, $d = 0.20$. Mood increased by 24.9%, $t(375) = 10.22$, $p < .001$, $d = 0.53$. Focus increased by 13.1%, $t(375) = 6.04$, $p < .001$, $d = 0.31$ (Figure 1). Thus, changes among engaged Autonomic users ranged from small to moderate, with the largest standardized effects for sleep and mood.

Figure 1

Pre- and post-assessment ratings for Autonomic users across the five outcome domains



Note. Ratings were collected on 1–10 sliders and rescaled to 0–100. Error bars represent 95% within-subject confidence intervals.

Discussion

The present study found that sustained engagement with Autonomic was associated with improved self-reported stress, sleep, energy, mood, and focus over 10 weeks. Standardized changes were small to moderate, with the largest effects observed for sleep and mood. In contrast, the independently recruited comparison group showed no statistically significant change over the same period. This pattern supports the interpretation that multidomain digital coaching may be associated with meaningful improvements in student functioning, while also requiring cautious interpretation because the design was nonrandomized.

Improvement across all five targeted domains is notable because sleep, stress, mood, energy, and focus are interrelated aspects of daily functioning rather than isolated outcomes. Better sleep is associated with attentional control, emotional regulation, and academic performance, whereas lower stress is associated with better mood and executive functioning (Bewick et al., 2010; Richardson et al., 2012). Autonomic's multidomain design may therefore be useful for students whose well-being and academic functioning reflect interactions among several modifiable factors. The present data cannot determine whether change in one domain drove change in another, but the coherent pattern supports further study of integrated rather than single-domain digital coaching.

The findings also demonstrate that measurable change can accompany a low-burden intervention delivered at scale. Autonomic sessions required only a few minutes, an important practical feature for university populations in which lack of time may limit engagement with conventional services. Digital delivery does not replace clinical care, but it may offer a complementary route for preventive support and daily self-management when students are not seeking or do not require intensive services. Future implementation research should examine not only effectiveness but also uptake, engagement, equity of reach, cost, and maintenance in routine university settings (Taylor et al., 2024).

More broadly, these findings position Autonomic as a potentially scalable tool for improving human performance. Effective performance depends not only on technical skill or

motivation, but also on the ability to sustain attention, regulate emotion and behaviour, and maintain goal-directed action—capacities that are vulnerable to stress, inadequate sleep, and depleted energy (Arnsten, 2009; Diamond, 2013; Leong & Chee, 2023). By targeting several of these modifiable foundations simultaneously, Autonomic may help users create the internal conditions needed to perform more consistently in academic, occupational, and everyday settings. This interpretation remains preliminary because objective performance was not measured directly; nevertheless, the observed improvements provide a rationale for future studies examining whether Autonomic-related changes in well-being translate into measurable gains in cognitive and real-world performance.

In conclusion, undergraduate users who sustained engagement with Autonomic reported small-to-moderate improvements in stress, sleep, energy, mood, and focus over 10 weeks, whereas an independently recruited non-intervention group showed no statistically significant within-group change. These findings provide encouraging real-world evidence of association, not proof of efficacy. They support a controlled prospective evaluation of Autonomic as a scalable, low-burden approach to promoting student well-being.

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Competing Interests

The first and second authors declare no competing financial or commercial interests and no employment, ownership, or advisory relationships with Autonomic Technologies. The senior author does have an advisory role with Autonomic but was not involved with data collection in any way and only saw the behavioural data following data collection. The statistical analysis was independently verified by the first and second authors.

Data Availability

Participant-level data are not publicly available because of privacy and commercial restrictions.

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