Guided Self-Help Features Improve Mental Health and Occupational Health for Depressed Working Adults - Longitudinal Observational Study

Sean Toh, Sze Chi Lee, Sherlyn Cheah, Oliver Suendermann

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Abstract

Background: Mental health problems are prevalent among employees and this negatively impacts their work engagement and productivity levels. Self-guided mobile interventions have recently emerged as a promising approach, offering greater accessibility, affordability, and anonymity compared to traditional employee assistance programs (EAPs). However, research on the effects of guided self-help features on occupational outcomes remains limited.

Objective: Using a non-randomized controlled design, this study compares the effectiveness of the "Intellect" app's guided self-help features in improving employees' mental and occupational health against a no-treatment control group over time.

Methods: Data from a subset of Intellect users registered between January 2023 and January 2024 were initially included in the analysis. Of these, 1,761 employees met the inclusion criteria for the study: (a) being 18 years or older, (b) working full-time, and (c) having completed Intellect's "Personal Insights" assessments across three timepoints. The "Personal Insights" assessment is a composite 20-item measure consisting of single items with higher factor loadings on their parent psychometric scales. These items assess various indicators of mental and occupational health. Participants who engaged with at least one guided self-help feature were assigned to the "Self-Guided Intervention" (SGI) condition (N = 1,555, M_{age} = 26.3, SD_{age} = 9.06), while those who did not engage with any of Intellect's features were assigned to the "Control" condition (N = 206, M_{age} = 28.8, SD_{age} = 10.3).

Results: At baseline, the average participant was severely depressed (M_{PHQ-4} = 10.2, SD_{PHQ-4} = 3.17) and took 84.87 days (SD = 79.05 days) to complete the third assessment. Linear mixed models revealed significant time by group interaction effects across various domains of mental and occupational well-being. SGI participants experienced significantly greater improvements in anxiety and depressive symptoms (P< .05), positive emotions (P< .05), perceived stress (P< .05), self-efficacy (P< .05), self-esteem (P< .01), work engagement (P< .05), turnover intentions (P=.05), psychological safety (P< .05), perceived organizational (P< .05) and social support (P< .01). Effect sizes for all of these improvements were small (Cohen's d = 0.14 - 0.21)

Conclusions: This study provides evidence that the guided self-help features on Intellect, a publicly available mental health app, effectively improve mental and occupational health for employees.

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Conclusion: This study provides evidence that the guided self-help features on Intellect, a publicly

available mental health app, effectively improve mental and occupational health for employees.

Key words: Observational study, longitudinal, mhealth, guided, self-help, self-guided, intervention,

mental health, workplace outcomes, occupational health.

1. Introduction

Mental health issues such as stress, anxiety, and depression are prevalent among employees

worldwide[1]. These issues, coupled with a lack of positive well-being factors (e.g., positive emotions,

emotional regulation skills, self-efficacy, self-esteem, meaning in life, and positive relationships),

can detrimentally affect workplace outcomes[2,3]. These include declining work engagement and

productivity, increased turnover intentions, and higher levels of absenteeism[4], and they carry heavy

financial implications for employers[5]. To mitigate these effects, many organizations have developed

and implemented workplace mental health programs, such as employee assistance programs (EAPs).

Despite their potential benefits, EAPs often suffer from very low utilization rates[6]. Their limited

accessibility outside of work hours and concerns about confidentiality previously discouraged

employees from using these services. These limitations, combined with the persistent impact of

mental health issues on occupational outcomes, have driven employers to seek innovative mental

health initiatives.

Digital self-help interventions have recently emerged as a promising approach. These

internet-based or mobile-based interventions offer several advantages over standard EAPs, such as

greater accessibility, lower cost, and anonymity when seeking help or treatment. Not only do users

have the flexibility to engage with these self-guided resources at their own pace and in their preferred environment, but the adaptability of current digital interventions also allows for tailoring to the diverse goals and interests of users. These features substantially reduce barriers to participation, which further increases engagement and intervention adherence[7]. Previous meta-analyses have demonstrated that mobile-based self-guided interventions (SGIs) have modest effects in reducing mental health symptoms and enhancing psychological well-being. Eisenstadt et al. (2022) identified 32 controlled trials evaluating the efficacy of mobile interventions and found a small pooled effect in reducing depression, anxiety, and stress (*Hedges' g* = -0.24) and improving psychological well-being (*Hedges' g* = 0.17)[8]. These small effect sizes are comparable to those reported in two earlier meta-analyses that included both online and app-based interventions[9,10].

While improving mental health symptoms is crucial, employers often request evidence of broader benefits to justify the investment in even low-cost programs. Therefore, further research is needed to explore the direct effects of digital self-help interventions on various workplace outcomes. To understand the degree of benefits potentially conferred by digital self-help interventions, it is essential to evaluate whether these interventions could sustain improvements on both mental health and work-related factors over time. Our current study aims to address these gaps using a non-randomized controlled design. Specifically, we investigated the effectiveness of guided self-help features on a mental health mobile application ("Intellect") in improving both mental health and workplace outcomes over time. By leveraging existing data from registered users of the Intellect platform, this longitudinal study will provide valuable insights into the potential of digital self-help interventions to enhance both individual well-being and organizational performance.

2. Methods

2.1. Study Design

Intellect is a publicly accessible digital platform that provides online counseling services and guided self-help activities based on evidence-based practices, including Cognitive Behavioral

Therapy (CBT), Mindfulness, Acceptance and Commitment Therapy (ACT), and Positive Psychology. This retrospective longitudinal study utilized existing data from registered users of the Intellect platform. The study focused on working adults who enrolled from January 2023, when Intellect launched its composite well-being measure, "Personal Insights", to January 2024. Users downloaded the app after agreeing to Intellect's Terms of Service and Privacy Policy, which included consent for the use of anonymized data for research purposes. All retrospective cohort data were deidentified. This study received an advisory review from the Advarra Institutional Review Board and was classified as minimal risk (Protocol: Pro00079593).

2.2. Study Participants

Individuals worldwide can publicly download "Intellect" from the Google Play and iOS App stores. Upon consenting to Intellect's Terms of Service and Privacy Policy, users proceed to set up their profiles by completing a survey that records their age, gender, working status, and whether they are employed by any of Intellect's corporate clients. A subset of users who registered an account from January 2023 to January 2024 were initially included in this dataset. While all registered users had access to self-care features, 1,598 users whose organizations purchased extra credits had additional access to Intellect's online counseling services. These users were excluded from the analysis as this study does not aim to evaluate the efficacy of online counseling. The remaining users were further screened for study eligibility, which included (a) being 18 years or older, (b) working full-time, and (c) having completed the Personal Insights Questionnaire at three different timepoints. A total of 46,805 users were excluded for not meeting at least one eligibility criterion. Users in the "Self-Guided Intervention" condition (d) completed at least one guided self-help feature during their usage, while users in the "Control" condition did not engage with any of Intellect's self-help features. Completing any self-guided feature on Intellect takes approximately 10 to 15 minutes. The final sample of 1,761 participants predominantly consists of females, with a mean age of 26.7 years (SD = 9.25, range = 18-60). To maintain a real-world evaluation, participants did not receive in-app

reminders to engage with the application or monetary reimbursement for their participation.
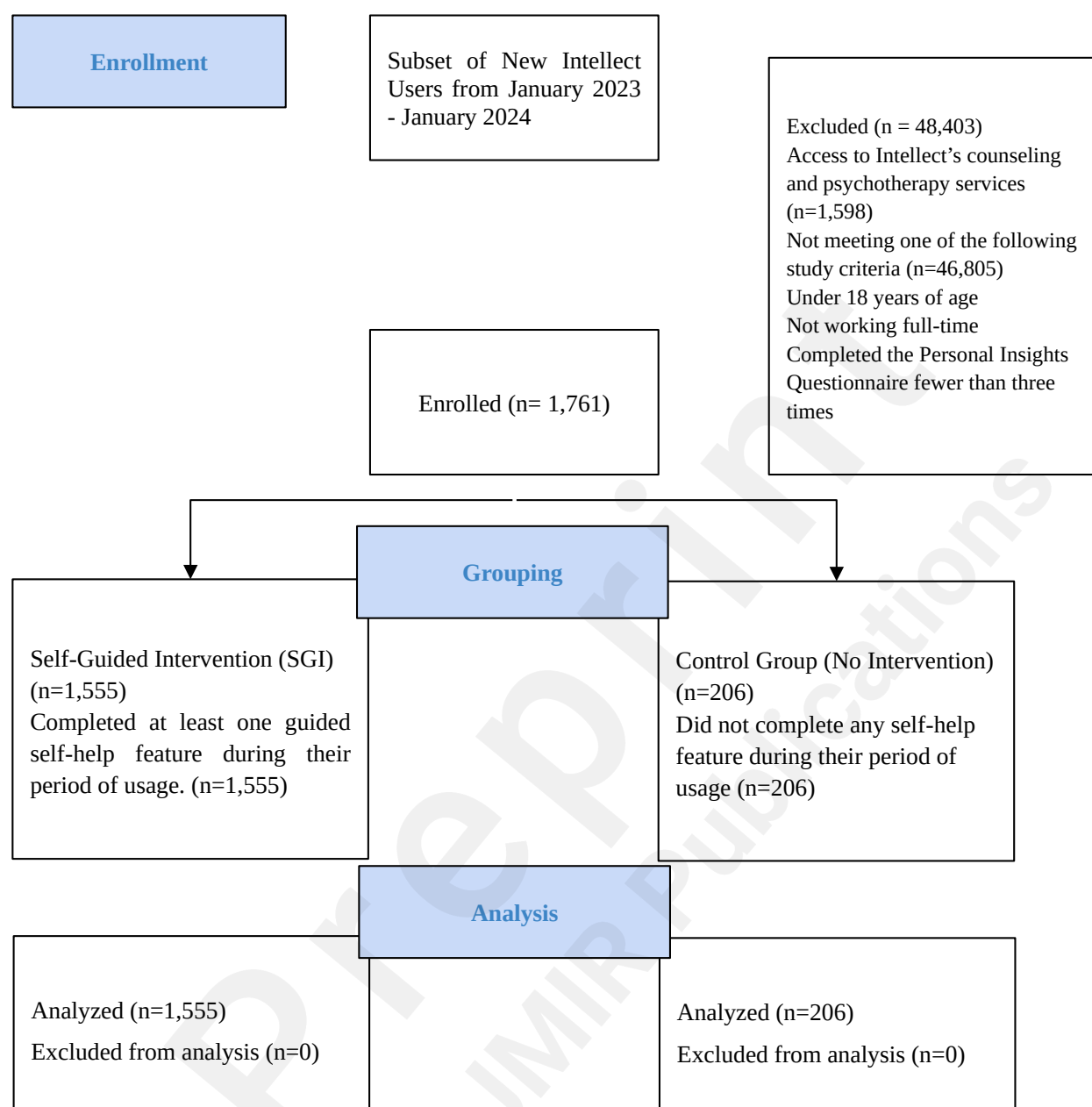
Enrollment	Subset of New Intellect Users from January 2023 - January 2024	Excluded (n = 48,403) Access to Intellect's counseling and psychotherapy services (n=1,598) Not meeting one of the following study criteria (n=46,805) Under 18 years of age Not working full-time Completed the Personal Insights Questionnaire fewer than three times

Enrolled (n= 1,761)

Grouping

Self-Guided Intervention (SGI) (n=1,555) Completed at least one guided self-help feature during their period of usage. (n=1,555)	Control Group (No Intervention) (n=206) Did not complete any self-help feature during their period of usage (n=206)

Analysis

Analyzed (n=1,555) Excluded from analysis (n=0)	Analyzed (n=206) Excluded from analysis (n=0)

Figure 1. Participant flowchart

2.3. Guided Self-Help Interventions

Participants can access a variety of guided self-help features on Intellect, including "Learning Paths", "Rescue Sessions", "Guided Journals", and "Toolkit". "Learning Paths" provide psychoeducation on different aspects of mental health and guide self-management using evidence-based practices. For example, the "Self-Esteem Learning Path" helps users identify cognitive distortions related to negative self-perceptions and guides them in reframing these negative

thoughts. "Rescue Sessions" target specific challenges commonly faced by working adults, such as 'overthinking', 'stress management', 'poor resilience', and 'burnout'. These sessions offer brief, in-the-moment support exercises, including cognitive reframing and mindfulness meditations. This comprehensive toolkit allows individuals to strengthen their mental resilience by selecting sessions relevant to their current struggles. Intellect's "Guided Journals" cover themes like 'reflection', 'problem-solving', 'goal-setting', 'sleep', and 'self-esteem'. For instance, the 'gratitude' journal prompts users to reflect on and record positive daily events, fostering a positive mindset and well-being. The "Toolkit" feature caters to participants who prefer a structured schedule for mindful self-care, offering brief mental and physical exercises throughout the day. The morning segment includes deep breathing exercises, the afternoon segment provides grounding techniques for mindful focus, and the evening segment focuses on sleep improvement through breathing meditation and cognitive defusion. The effectiveness of these features has been established in randomized controlled trials and longitudinal studies[11,12,13,14].

2.4. Primary Outcome Measure: Personal Insights

The "Personal Insights" assessment tool is a composite 20-item measure consisting of single items with higher factor loadings on their parent psychometric scales. It includes a well-being component and an occupational component.

2.4.1 Well-Being Component

The well-being component comprises 13 items, including the Patient Health Questionnaire-4 (PHQ-4) and single-item measures for various aspects of mental health:

2.4.1.1 Anxiety and Depressive Symptoms

The PHQ-4, a widely used 4-item measure, assesses depressive symptoms[15]. Each item is rated on a 4-point scale (0 = "Not at all" to 3 = "Nearly every day"), with higher scores indicating

more severe symptoms. The total score ranges from 0 to 12, with cutoffs at 3, 6, and 9 for mild, moderate, and severe depression, respectively.

2.4.1.2 Positive Emotions

Adapted from the PERMA Profile – Positive and Negative Emotions subscale[16], this item asks, "I consider myself pretty happy overall,", rated on a 5-point Likert scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.3 Emotional Regulation

Adapted from the Regulatory Emotional Self-Efficacy Scale (RES)[17], this item asks, "I can easily avoid getting upset when others keep giving me a hard time," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.4 Perceived Stress

Adapted from the Perceived Stress Scale (PSS-10)[18], this item asks, "Over the last month, I often feel that I was able to cope with all of my tasks and responsibilities," rated on a 5-point scale (1 = 'Never' to 5 = 'Very Often').

2.4.1.5. Self-Efficacy

Adapted from the General Self-Efficacy Scale (GSE)[19], this item states, "It is easy for me to stick to my aims and accomplish my goals," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.6. Self-Esteem

Adapted from the Rosenberg Self-Esteem Scale[20], this item asks, "I feel that I'm a person of worth, or at least equal to others," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.7. Resilience

Adapted from the Connor-Davidson Resilience Scale (CD-RISC)[21], this item states, "I feel that I can handle whatever comes my way," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.8. Meaning

Adapted from the Flourishing Scale[22], this item asks, "I generally feel that what I do in my life is valuable and worthwhile," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.9. Positive Relationships

Adapted from the PERMA Profile – Positive Relationships subscale[16], this item asks, "To what extent do you receive help and support from people you are close to when you need it?" rated on an 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.1.10. Growth Mindset about Mental Health

Adapted from the Implicit Theories of Well-Being Scale[23], this item states, "Your mental well-being is something that you cannot change very much," rated on a 5-point scale (1 = 'Strongly Agree' to 5 = 'Strongly Disagree').

2.4.2. Occupational Component

The occupational component comprises 7 items, each assessing Work Engagement, Turnover Intentions, Psychological Safety, Perceived Organizational and Social Support, Work-life Balance, and Absenteeism.

2.4.2.1. Work Engagement

Adapted from the ISA Engagement Scale developed by Soane et al. (2012)[24], this item asks, "I feel energetic about my work," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.2.2. Turnover Intentions.

Adapted from the Turnover Intention Scale developed by Bothma and Roodt (2013)[25], this item asks, "I often consider leaving my job," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.2.3. Psychological Safety at the Workplace.

Adapted from the 5-item Psychological Safety Scale developed by Edmondson (1999)[26], this item asks, "In my organization, I can freely express my thoughts," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.2.4. Perceived Organizational Support.

This item, adapted from the Perceived Organizational Support Scale developed by Eisenberger et al. (1986)[27], asks, "My organization really cares about my wellbeing," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.2.5. Perceived Social Support at the Workplace

Adapted from the Multidimensional Scale of Perceived Social Support developed by Zimet et al. (1998)[28], this item was modified by changing "friends" to "colleagues." The resulting question asks, "I can talk about my problems with my colleagues," rated on a 5-point scale (1 = 'Strongly Disagree' to 5 = 'Strongly Agree').

2.4.2.6. Work-Life Balance

Adapted from the Work-Life Balance Scale developed by Agha et al. (2017)[29], this item asks, "The demands of my job cause me to neglect significant aspects of my personal life," rated on a 5-point scale (1 = 'Strongly Agree' to 5 = 'Strongly Disagree').

2.4.2.7. Absenteeism

Adapted from the Work Productivity and Activity Impairment Questionnaire (WPAI)

developed by Reilly et al. (1993)[30], this item asks participants to indicate the number of days they

missed work due to mental or physical health reasons (e.g., stress, fatigue, illness) over the last

month.

2.5. Statistical Analyses

Descriptive statistics were computed using IBM SPSS Statistics 29.0. Group differences for

baseline categorical variables were assessed using chi-square tests. Given the unequal group sizes,

Welch t-tests were used to assess any baseline differences in continuous variables. Intervention

effects on primary outcomes will be evaluated using Linear Mixed Models (LMM) in R. These

models accommodate missing data and time-varying covariates, which assess the dynamic

relationships between variables accurately over time. They are also well equipped to handle unequal

group sizes[31,32]. In the LMMs, fixed effects include "Group", "Time", the interaction between time

and group (i.e. Time x Group), and covariates (variables indicating significant baseline differences

between the "Self-Guided Intervention" and "Control" groups at baseline, and demographic

characteristics). Participants were included as random intercepts. The "Group" variable was coded

binarily (0 = 'Control', 1 = 'SGI'), while "Time" represented the three timepoints of data collection.

Mean-centering was conducted to compute a more accurate cross-level interaction by separating

within- from between-subject effects. "Group", "Time" and demographic variables (age and gender)

were grand-mean centered to provide meaning to their intercepts. The grand-mean centering of

"Group" and "Time" also reduced multicollinearity with their interaction term. Within-group effect

sizes (Cohen's d) were determined by dividing the difference in mean scores of the outcome variable

across two timepoints by their pooled standard deviation. Between-group effect sizes (Cohen's d)

were calculated by subtracting the within-group effect sizes from each other[33].

3. Results

3.1. Participants

Table 1 displays the baseline sample characteristics of individuals in the SGI and Control conditions. Most importantly, the two groups were not statistically different in gender, days between assessments, and baseline scores for nearly all of the Personal Insights' items (all ps > .05) except for Positive Relationships (Control: M = 3.22, SD = 1.12; SGI: M = 3.40, SD = 1.12, p = .03). The groups, however, were statistically different in age and affiliation with Intellect, where the average participant in the control condition is older (Control: M_{age} = 28.8, SD_{age} = 10.3; SGI: M_{age} = 26.3, SD_{age} = 9.06, p < .01) and more likely to be a corporate client of Intellect ($F(1, 218.4)$ = 34.4, p < .001) in comparison to the average participant in the intervention group. Notably, as measured by the PHQ-4, the average participant in this sample is severely depressed at baseline (M = 10.2, SD = 3.17). On average, participants took 84.87 days from baseline (SD = 79.05 days) to complete the final assessment.

Table 1. Descriptive Statistics for Demographics and Outcome Variables by Condition

Variables	Intervention Condition (N = 1,555)	Active Control Condition (N = 206)	*p-value*
	M (SD)	*M (SD)*	
Age	26.38 (9.06)	28.82 (10.35)	*0.002*
Days between 1st and 2nd assessment	40.3 (51.9)	34.1 (44.2)	0.07
Days between 1st and 3rd assessment	86.0 (79.5)	76.0 (75.3)	0.08

		N (%)	N (%)	
Gender	Female	960 (61.7%)	109 (52.9%)	0.08
	Male	514 (33.1%)	85 (41.3%)	
	Non-Binary	36 (2.3%)	7 (3.4%)	
	Others	45 (2.9%)	5 (2.4%)	
Intellect's Corporate Client	Yes	105 (6.8%)	52 (25.2%)	*<0.001*
	No	1,450 (93.2%)	154 (74.8%)	
PHQ-4		10.19 (3.17)	10.09 (3.23)	0.680
Positive Emotions		2.97 (1.10)	2.92 (1.17)	0.516
Emotional Regulation		2.55 (1.16)	2.58 (1.23)	0.755
Perceived Stress		3.07 (1.20)	3.02 (1.13)	0.581
Self-Esteem		3.56 (1.15)	3.45 (1.08)	0.208
Self-Efficacy		2.68 (1.12)	2.77 (1.18)	0.294
Resilience		3.15 (1.16)	3.17 (1.18)	0.902
Meaning		3.28 (1.15)	3.20 (1.08)	0.310
Positive Relationships		3.40 (1.12)	3.22 (1.12)	*0.031*
Growth Mindset		2.98 (1.24)	2.96 (0.09)	0.760
Work Engagement		2.95 (1.07)	3.05 (1.10)	0.221
Turnover Intentions		3.01 (1.26)	2.91 (1.31)	0.310
Psychological Safety		2.89 (1.06)	2.95 (1.02)	0.428
Perceived Organizational Support		2.88 (1.08)	2.94 (1.07)	0.427
Perceived Social Support at the Workplace		3.25 (1.25)	3.39 (1.17)	0.103
Work-Life Balance		2.94 (1.14)	3.03 (1.11)	0.285
Absenteeism		2.34 (1.64)	2.21 (1.36)	0.193

PHQ-4 = Patient Health Questionnaire-4

3.2. Changes in Well-Being Components Over Time

Fixed effects of time, group, time x group interactions as well as for covariates (i.e., age, gender, affiliation with Intellect) for each well-being outcome are presented in Table 2. Statistically significant effects of time x group interaction were observed for the following well-being outcomes: anxiety and depressive symptoms (PHQ-4), positive emotions, perceived stress, self-efficacy, and self-esteem (all ps < 0.05). Meanwhile, the time x group interaction effect for emotional regulation skills was approaching significance ($p = 0.07$). This indicates that the trajectory of change for these outcomes differed between the "Self-Guided Intervention" and "Control" participants across time, even after controlling for all covariates (PHQ-4: $b = -0.289$, $SE = 0.143$, $p = <.05$; Positive Emotions: $b = 0.081$, $SE = 0.037$, $p <.05$; Emotional Regulation: $b = 0.078$, $SE = 0.043$, $p = .07$; Perceived Stress: $b = -0.130$, $SE = 0.056$; $p <.05$; Self-Efficacy: $b = 0.081$, $SE = 0.040$; $p <.05$; Self-Esteem: $b = 0.118$, $SE = 0.040$; $p < .01$). The between-group effect sizes for these outcomes were generally small, with most effect sizes from baseline to the third assessment (from $d = 0.14$ to 0.21) being larger than those from baseline to the second assessment (see Table 3). For the remaining well-being outcomes, the time x group interaction effects were not statistically significant (Resilience: $b = -0.289$, $SE = 0.143$, $p = <.05$; Meaning: $b = 0.081$, $SE = 0.037$, $p <.05$; Positive Relationships: $b = 0.078$, $SE = 0.043$, $p = .07$; Growth Mindset: $b = 0.118$, $SE = 0.040$; $p < .01$). Consequently, their between-group effect sizes were very small ($d \leq 0.13$).

Table 2: Fixed Effects on Well-Being Outcomes

Well-Being Outcomes	Effect	B (SE)	*p-value*
PHQ-4	Time	-.105 (.134)	.434
	Group	.302 (.337)	.371
	Time x Group	*-.289 (.143)*	*<.05*
	Age	0.000 (.001)	.984
	Gender	-.143 (.089)	.107
	Intellect's Corporate Client (Yes/No)	*.603 (.226)*	*<.01*
Positive Emotions	Time	.025 (.035)	.476
	Group	.080 (.105)	.445
	Time x Group	*.081 (.037)*	*<.05*

	Age	-.002 (.002)	.307
	Gender	-.033 (.034)	.335
	Intellect's Corporate Client (Yes/No)	*-.343 (.088)*	*<.001*
Emotional Regulation	Time	.043 (.041)	.296
	Group	-.111 (.112)	.324
	Time x Group	.078 (.043)	.072
	Age	*-.001 (.003)*	*<.01*
	Gender	*.212 (.034)*	*<.001*
	Intellect's Corporate Client (Yes/No)	-.074 (.086)	.386
Perceived Stress	Time	.075 (.052)	.153
	Group	.128 (.130)	.325
	Time x Group	*-.130 (.056)*	*<.05*
	Age	.002 (.002)	.392
	Gender	-.047 (.030)	.113
	Intellect's Corporate Client (Yes/No)	*.326 (.056)*	*<.001*
Self-Efficacy	Time	.020 (.038)	.595
	Group	-.044 (.108)	.682
	Time x Group	*.081 (.040)*	*<.05*
	Age	.000 (.003)	.880
	Gender	-.001 (.034)	.979
	Intellect's Corporate Client (Yes/No)	*-.484 (.089)*	*<.001*
Self-Esteem	Time	.005 (.037)	.892
	Group	-.001 (.111)	.986
	Time x Group	*.118 (.039)*	*<.01*
	Age	.000 (.003)	.866

	Gender	.029 (.035)	.423
	Intellect's Corporate Client (Yes/No)	.037 (.090)	.681
Resilience	Time	.035 (.038)	.356
	Group	-.058 (.112)	.604
	Time x Group	.066 (.040)	.100
	Age	*-.006 (.003)*	*<.05*
	Gender	.036 (.035)	.307
	Intellect's Corporate Client (Yes/No)	.015 (.089)	.865
Meaning	Time	.050 (.041)	.218
	Group	.109 (.112)	.330
	Time x Group	.051 (.043)	.237
	Age	-.001 (.003)	.600
	Gender	.010 (.034)	.762
	Intellect's Corporate Client (Yes/No)	*-.215 (.086)*	*<.05*
Positive Relationships	Time	.018 (.039)	.656
	Group	.165 (.110)	.133
	Time x Group	.034 (.042)	.418
	Age	.001 (.003)	.713
	Gender	-.005 (.034)	.893
	Intellect's Corporate Client (Yes/No)	-.147 (.086)	.086
Growth Mindset	Time	*.115 (.056)*	*<.05*
	Group	-.028 (.137)	.839
	Time x Group	.034 (.060)	.566
	Age	.004 (.003)	.114
	Gender	-.041 (.035)	.230

	Intellect's Corporate Client (Yes/No)	.035 (.088)	.694

Table 3: Effect Sizes for Well-Being Outcomes (Cohen's d)

Well-Being Outcomes	Intervention (N = 1,555)	Within-Group ES	Control (N = 206)	Within-Group ES	Between-Group ES
	M (SD)	*Cohen's d*	*M (SD)*	*Cohen's d*	*Cohen's d*
PHQ-4					
Baseline	10.19 (3.17)	N/A	10.09 (3.23)	N/A	N/A
Second Assessment	9.97 (3.14)	-0.07	10.12 (3.34)	0.01	-0.08
Final Assessment	9.40 (3.15)	-0.25	9.89 (3.29)	-0.06	-0.19
Positive Emotions					

Baseline	2.97 (1.10)	N/A	2.92 (1.17)	N/A	N/A
Second Assessment	3.17 (1.11)	0.18	2.94 (1.13)	0.02	0.16
Final Assessment	3.18 (1.11)	0.19	2.96 (1.12)	0.03	0.16
Emotional Regulation					
Baseline	2.55 (1.16)	N/A	2.58 (1.23)	N/A	N/A
Second Assessment	2.64 (1.14)	0.08	2.67 (1.16)	0.08	0.00
Final Assessment	2.79 (1.13)	0.21	2.65 (1.16)	0.06	0.15
Perceived Stress					
Baseline	3.07 (1.20)	N/A	3.02 (1.14)	N/A	N/A
Second Assessment	3.03 (1.15)	-0.03	3.07 (1.07)	0.05	-0.08
Final Assessment	2.96 (1.13)	-0.09	3.15 (1.10)	0.12	-0.21
Self-Efficacy					
Baseline	2.68 (1.12)	N/A	2.77 (1.18)	N/A	N/A
Second Assessment	2.80 (1.09)	0.11	2.75 (1.14)	0.02	0.09
Final Assessment	2.87 (1.12)	0.17	2.80 (1.11)	0.03	0.14
Self-Esteem					
Baseline	3.56 (1.15)	N/A	3.45 (1.22)	N/A	N/A
Second Assessment	3.74 (1.12)	0.16	3.44 (1.24)	0.01	0.15
Final Assessment	3.81 (1.10)	0.22	3.47 (1.21)	0.02	0.20
Resilience					
Baseline	3.15 (1.16)	N/A	3.17 (1.18)	N/A	N/A

Second Assessment	3.31 (1.14)	0.14	3.16 (1.10)	0.01	0.13
Final Assessment	3.35 (1.12)	0.18	3.24 (1.23)	0.06	0.12
Meaning					
Baseline	3.28 (1.16)	N/A	3.20 (1.08)	N/A	N/A
Second Assessment	3.44 (1.09)	0.14	3.25 (1.12)	0.05	0.09
Final Assessment	3.48 (1.14)	0.17	3.28 (1.10)	0.07	0.10
Positive Relationships					
Baseline	3.40 (1.12)	N/A	3.22 (1.12)	N/A	N/A
Second Assessment	3.48 (1.11)	0.07	3.28 (1.14)	0.05	0.02
Final Assessment	3.50 (1.13)	0.09	3.24 (1.22)	0.02	0.07
Growth Mindset					
Baseline	2.98 (1.29)	N/A	2.96 (1.24)	N/A	N/A
Second Assessment	2.78 (1.32)	0.15	2.89 (1.25)	0.06	0.09
Final Assessment	2.68 (1.29)	0.23	2.71 (1.20)	0.20	0.03

3.3. Changes in Workplace Outcomes Over Time

Fixed effects of time, group, time x group interactions as well as for covariates (i.e., age, gender, affiliation with Intellect) for each workplace outcome are presented in Table 4. Statistically significant effects of time x group interaction were observed for the following workplace outcomes: Work Engagement, Turnover Intentions, Psychological Safety at the Workplace, Perceived Organizational Support, and Perceived Social Support at the Workplace (all ps < 0.05). This indicates that the trajectory of change for these outcomes differed between the "Self-Guided Intervention" and

"Control" participants across time, even after controlling for all covariates (Work Engagement: b = -0.289, SE = 0.143, p = <.05; Turnover Intentions: b = 0.081, SE = 0.037, p <.05; Psychological Safety: b = 0.078, SE = 0.043, p = < .05; Perceived Organizational Support: b = -0.130, SE = 0.056; p <.05; Perceived Social Support at the Workplace: b = 0.081, SE = 0.040; p <.05). The between-group effect sizes for these workplace outcomes from baseline to the final assessment were generally small (from d = 0.15 to 0.21) (see Table 5). For the remaining workplace outcomes, the time x group interaction effects were not statistically significant (Resilience: b = -0.289, SE = 0.143, p = <.05; Meaning: b = 0.081, SE = 0.037, p <.05; Positive Relationships: b = 0.078, SE = 0.043, p = .07; Growth Mindset: b = 0.118, SE = 0.040; p < .01).

Table 4: Fixed Effects on Workplace Outcomes

Workplace Outcomes	Effect	B (SE)	*p-value*
Work Engagement	Time	-.015 (.039)	.697
	Group	-.131 (.107)	.229
	Time x Group	*.084 (.041)*	*<.05*
	Age	*.005 (.002)*	*<.05*
	Gender	.011 (.031)	.720
	Intellect's Corporate Client (Yes/No)	-.163 (.079)	*<.05*
Turnover Intentions	Time	.020 (.055)	.714
	Group	.193 (.135)	.152
	Time x Group	-.*112 (.058)*	*.050*
	Age	*.007 (.003)*	*<.05*
	Gender	-.070 (.035)	.062
	Intellect's Corporate Client (Yes/No)	-.029 (.058)	.747
Psychological Safety	Time	-.028 (.040)	.487
	Group	-.073 (.106)	.493
	Time x Group	*.089 (.042)*	*<.05*
	Age	*.005 (.002)*	*<.05*

	Gender	.013 (.031)	.681
	Intellect's Corporate Client (Yes/No)	*-.220 (.080)*	*<.01*
Perceived Organizational Support	Time	-.040 (.037)	.285
	Group	-.036 (.104)	.732
	Time x Group	*.092 (.040)*	*<.05*
	Age	.001 (.002)	.706
	Gender	-.052 (.032)	.106
	Intellect's Corporate Client (Yes/No)	*-.517 (.083)*	*<.001*
Perceived Social Support at the Workplace	Time	-.066 (.042)	.114
	Group	.024 (.121)	.843
	Time x Group	*.134 (.044)*	*<.01*
	Age	*.011 (.003)*	*<.001*
	Gender	*-.106 (.037)*	*<.01*
	Intellect's Corporate Client (Yes/No)	-.052 (.096)	.587
Work Life Balance	Time	.000 (.054)	.999
	Group	-.130 (.128)	.310
	Time x Group	.035 (.057)	.534
	Age	.003 (.002)	.123
	Gender	.014 (.028)	625
	Intellect's Corporate Client (Yes/No)	.026 (.071)	.717
Absenteeism	Time	-.013 (.057)	.828
	Group	.144 (.163)	.378
	Time x Group	-.068 (.061)	.263
	Age	-.001 (.003)	.869
	Gender	.013 (.046)	.774

	Intellect's Corporate Client (Yes/No)	*.293 (.118)*	*<.05*

Table 5: Effect Sizes for Workplace Outcomes (Cohen's d)

Workplace Outcomes	Intervention (N = 1,555)	Within-Group ES	Control (N = 206)	Within-Group ES	Between-Group ES
	M (SD)	*Cohen's d*	*M (SD)*	*Cohen's d*	*Cohen's d*
Work Engagement					
Baseline	2.95 (1.07)	N/A	3.05 (1.09)	N/A	N/A
Second Assessment	3.01 (1.05)	0.06	3.02 (1.05)	-0.03	0.09
Final Assessment	3.08 (1.04)	0.12	3.00 (1.00)	-0.05	0.17

Turnover Intentions					
Baseline	3.01 (1.26)	N/A	2.91 (1.31)	N/A	N/A
Second Assessment	2.86 (1.27)	-0.12	2.93 (1.21)	0.02	-0.14
Final Assessment	2.82 (1.28)	-0.15	2.98 (1.18)	0.06	-0.21
Psychological Safety					
Baseline	2.89 (1.06)	N/A	2.95 (1.02)	N/A	N/A
Second Assessment	2.97 (1.08)	0.07	2.84 (1.02)	-0.11	0.18
Final Assessment	3.01 (1.09)	0.11	2.91 (1.02)	-0.04	0.15
Perceived Organizational Support					
Baseline	2.88 (1.08)	N/A	2.94 (1.07)	N/A	N/A
Second Assessment	2.94 (1.08)	0.06	2.80 (1.08)	-0.13	0.19
Final Assessment	2.98 (1.09)	0.09	2.88 (1.05)	-0.06	0.15
Perceived Social Support at the Workplace					
Baseline	3.25 (1.25)	N/A	3.39 (1.18)	N/A	N/A
Second Assessment	3.18 (1.23)	0.06	3.42 (1.22)	-0.02	0.08
Final Assessment	3.11 (1.25)	0.11	3.45 (1.14)	-0.05	0.16
Work-Life Balance					
Baseline	2.94 (1.14)	N/A	3.03 (1.11)	N/A	N/A

Second Assessment	3.02 (1.15)	0.07	3.05 (1.11)	0.02	0.05
Final Assessment	3.00 (1.17)	0.05	3.04 (1.13)	0.01	0.04
Absenteeism					
Baseline	2.34 (1.64)	N/A	2.21 (1.35)	N/A	N/A
Second Assessment	2.28 (1.60)	-0.04	2.15 (1.39)	-0.04	0.00
Final Assessment	2.18 (1.52)	-0.10	2.20 (1.48)	-0.01	-0.09

4. Discussion

Using a non-randomized controlled design, this study evaluated the effectiveness of guided self-help features on a mental health mobile application ("Intellect") in improving both mental health and workplace outcomes over time.

4.1. Well-Being Outcomes

Intellect's self-guided features demonstrated significant improvements in several emotional outcomes, including anxiety and depressive symptoms, positive emotions, perceived stress, and emotional regulation (partially significant). Additionally, we observed improvements in self-concept-related outcomes such as self-efficacy and self-esteem. One possible explanation is that these outcomes can be effectively modified through CBT techniques, which are central to Intellect's features. Cognitive distortions or biases, such as magnifying negatives and minimizing positives, often contribute to many mental health problems[34] and poor self-concepts[35]. These distortions can be effectively addressed through thought-reframing exercises, such as cognitive restructuring or Socratic questioning, which are present within many self-guided features on the Intellect app. Similar findings have been reported in recent randomized controlled trials (RCTs) evaluating brief CBT mobile interventions[36,37,38].

As expected, we observed significant improvements over time on anxiety and depression, positive emotions, perceived stress, self-efficacy, and self-esteem. These effect sizes were relatively small (d = 0.14 - 0.21) compared to those reported by recent RCTs comparing CBT apps with wait-list or inactive controls[37,38]. For instance, the meta-analysis conducted by Firth et al. (2017) reported between-group average ESs of d = 0.45 for anxiety and d = 0.56 for depression[39]. There are a few possible explanations for our findings. First, since this is a real-world evaluation study, the intervention dosage received by participants might be lower than in controlled studies. From baseline to their final assessment, the average participant in our intervention group engaged with 8.9 self-guided features (SD = 28.1), equating to about 89

minutes spent on the Intellect app. This dosage is lower than the minimum effective dose for app-based mobile interventions to reduce anxiety and depressive symptoms (i.e., 7 weeks of minimal engagement), as reported in various meta-analyses[40,41,42]. Second, our sample consists of working adults who were severely depressed at baseline (M_{PHQ-4} = 10.2). Some studies, such as Lovell et al. (2008), suggest that individuals with severe depressive symptoms at baseline benefit less from guided self-help interventions compared to those with milder symptoms[43]. Lovell et al. (2008) also proposed that guided self-help features may need to specifically target individual predictors of depression to be effective for those with severe symptoms. Given that self-help interventions often show limited effects on promoting the well-being of clinically depressed working adults, Intellect's guided self-help features show some promise and warrant closer examination as a viable self-help intervention for this clinical population. Future studies could explore this by isolating the effects of Intellect's features on clinically depressed working adults in a separate RCT.

Contrary to some studies (e.g., Schure et al., 2019; Hwang et al., 2022)[44,45] but not all (e.g., Elledge et al., 2023)[46], Intellect's guided self-help features did not significantly improve enduring or interpersonal well-being outcomes such as resilience, meaning in life, growth mindset about mental health, and relationship quality. One probable reason is that these variables are influenced by numerous factors not easily changeable through brief interventions. For example, resilience can be shaped by an individual's personality traits or physiological habits, and sustained improvements in these areas typically require psychotherapy or professional counseling services. Changing an individual's sense of meaning in life is complicated, as meaning is seen as a highly subjective variable tied to personal goals[47,48]. Similarly, relationship quality is influenced by the characteristics of both parties involved, such as the compatibility in communication styles[49]. Promoting growth mindsets about mental health involves active self-reflection on one's current mindset and witnessing the possibility of change. Although carefully designed single-session interventions, like a 10-minute writing activity, have achieved success in

this area[50,51], Intellect's features currently lack these components and this presents an opportunity for further feature enhancements.

4.2. Workplace Outcomes

Intellect's self-guided features also demonstrated significant improvements in several workplace outcomes, such as work engagement, psychological safety, perceived organizational and social support at the workplace, and significant reductions in turnover intentions. These results extend the small evidence base suggesting that mobile interventions can enhance employees' engagement and productivity[52]. Our small between-group effect sizes (d = 0.17 - 0.21) were also comparable to the pooled effect sizes reported in Stratton et al. (2021)'s meta-analysis evaluating the overall efficacy of mobile interventions on workplace outcomes (*Hedges' g* for work engagement = 0.19; *Hedges' g* for work productivity = 0.16)[53].

Previous studies have offered some insights to our current findings. Mindfulness meditations, which are known to improve attentional control, could enhance employees' ability to focus and stay engaged at work[54,55,56]. The mindfulness-based mobile app "Calm," which uses similar mindfulness exercises (e.g., breathing and body scan meditations) to those in Intellect's "Learning Paths", "Rescue Sessions", and "Toolkit", has also been shown to improve users' productivity at work and presenteeism outcomes in an RCT[57]. In a separate study, "Calm" users who were remote office workers exhibited significantly greater psychological safety than those who did not use the app[58]. While these authors did not elaborate on this finding, it is conceivable that the non-judgmental attitude and compassion cultivated through mindfulness practices, or engaging in more mindful interactions with colleagues and leaders, contribute to greater trust and support within the organization. This reason could also explain why participants in our intervention group reported greater perceived social and organizational support at the workplace. Furthermore, fostering a habit of considering alternative perspectives through CBT exercises (e.g., thought reframing) could enable employees to reinterpret stressors differently. CBT interventions have led employees to feel safer and more supported at the workplace[59]. These

positive experiences at the workplace could cumulatively cascade down to lower levels of turnover intentions.

Despite these improvements, Intellect's self-help features did not succeed in addressing broader workplace outcomes, such as promoting better work-life balance or reducing absenteeism. The latter result aligns with the findings of various studies[36,57,60], including a recent meta-analysis conducted by Stratton et al. (2021), which found minimal and nonsignificant pooled effect sizes for absenteeism across 28 mobile-health interventions[53]. Huberty et al. (2022) proposed that absenteeism is often linked with more severe mental health issues, suggesting that employees may require additional support beyond self-guided interventions (e.g., brief, focused behavioral health coaching) to effectively manage mental health-related absences[57]. It is notable that despite the observed enhancements in work engagement, these improvements did not lead to better work-life balance outcomes. This outcome may seem unexpected given that work engagement is typically associated with higher productivity levels among employees. However, achieving work-life balance is influenced by various factors, including the workload imposed by the organization (e.g., Omar et al., 2020)[61] and individual preferences regarding the allocation of personal time versus work commitments. For instance, an employee who remains engaged at work may still struggle to maintain a healthy work-life balance if they have difficulty establishing boundaries between work and personal life[62] or if they voluntarily choose to work overtime.

5. Strengths, Limitations, and Future Directions

This study was a naturalistic, observational analysis of existing Intellect users from January 2023 to January 2024. Despite the large sample size and rigorous statistical methods, several limitations must be acknowledged. First, the absence of randomization prevents us from making causal inferences about the intervention's effectiveness. Second, though the use of real-world data enhances external validity and provides a realistic assessment of the effectiveness of

Intellect's self-guided features, the self-selection of participants poses a challenge. Those who remained engaged with the application and completed three "Personal Insights" assessments may differ significantly from the general population, which limits the generalizability of our findings. Third, participants might have used other wellbeing applications alongside Intellect's features, which would have confounded our results. Fourth, the actual effort participants invested in completing the self-guided interventions was not controlled for, and we also did not collect data on the time spent practicing the skills learned after the intervention itself. Consequently, it is possible that the observed positive effects could be influenced by variables not assessed in this study. Fifth, it was technically challenging to identify the specific type of self-help feature each participant engaged with, as our SGIs incorporate multiple modalities. For instance, a typical "Learning Path" on the Intellect app comprises both CBT and mindfulness exercises. Access to these detailed data would enable researchers to conduct further analyses to identify which features led to specific improvements in occupational and well-being outcomes. Lastly, this study has limited external validity for the broader working population, as the sample primarily consisted of relatively young (M_{age} = 26.7 years, SD_{age} = 9.25) female employees (60.7%) residing in the Asia-Pacific region. Previous research has indicated that women are often overrepresented in internet-based studies[63], which may reflect the demographic most likely to use digital mental health interventions but this again limits the generalizability of the findings.

To address these limitations and build on our preliminary findings, future researchers should employ more rigorous designs such as RCTs. Including randomized treatment and control groups and assessing all participants with the "Personal Insight" items at standardized timepoints would enhance the reliability of the results. An active control group consisting of psychoeducational content could help rule out placebo effects and allow for causal inferences about the effectiveness of Intellect's guided features. Additionally, controlled studies would prevent participants from using other wellbeing applications simultaneously and this minimizes

the chances of confounding the study's findings. To enhance the external validity of these findings, the RCT should also be conducted with a more diverse sample, including more employees residing in countries beyond the Asia-Pacific region.

6. Conclusion

In conclusion, this nonrandomized controlled study evaluated the effectiveness of Intellect's self-guided mental health features in improving well-being and workplace outcomes among users. Significant improvements were observed in anxiety and depressive symptoms, perceived stress, positive emotions, self-efficacy, self-esteem, work engagement, psychological safety, perceived organizational and social support, and turnover intentions. Despite these positive findings, Intellect's features did not enhance longer-term outcomes such as resilience, meaning in life, positive relationships, growth mindset, work-life balance or reduce absenteeism. The study's limitations underscore the need for more rigorous research designs, such as randomized controlled trials, to fully understand the potential of self-guided features in improving employees' outcomes. While most of the observed effect sizes were small, these can translate into significant improvements of public mental health at the population level.

Acknowledgements

Data Availability

The data analyzed in this study are not publicly available because of the restricted permissions and confidentiality shared between Intellect and its users. The data will only be available upon reasonable requests made to the corresponding author.

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Declaration of competing interest

The authors declare the following interests which may be considered as potential competing interests: Oliver Suendermann (OS) holds the position of Clinical Director at Intellect Pte Ltd; he also reports holding equity in Intellect. Lee Sze Chi (LSC) is the current Research Lead at Intellect. Sherlyn Cheah (SC) is the current Research Associate at Intellect. At the time of writing, Sean Toh Han Yang (STHY) was a Clinical Research Associate for Intellect.

Authors' Contributions

STHY conceived the study, led the data analysis, and directed the manuscript writing and development. SC assisted in cleaning and organizing the study's dataset. LSC and OS reviewed and edited the initial draft. LSC and STHY collaborated to finalize the manuscript. All authors approved the final submitted version.

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Supplementary Files

Figures

Participant Flowchart.