Occupational Science & Occupational Therapy
UNIVERSITY OF TORONTO

Brainbot, An Innovative mHealth App for Concussion Self-Management and Occupational Performance in Adults: A Mixed Methods Study Investigating Usability

STACY MA; AVA PEILL; SHELLEY VAISBERG; ANNE HUNT

DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY, TEMERTY FACULTY OF MEDICINE, UNIVERSITY OF TORONTO, TORONTO, ON

Background

- Concussions affect almost 2% of the population [1], with over half experiencing incomplete functional recovery within 6 months [2].
- Persistent Post Concussion Symptoms (PPCS) often last for years, affecting occupational performance and categorizing mild traumatic brain injury (mTBI) as a chronic condition [3].
- Current mTBI healthcare focuses on emergency and acute care, with notable challenges in maintaining adherence to interventions post-discharge [2,3].
- There is a critical demand for community-based, holistic, long-term approaches, particularly flexible and validated self-management tools for daily life integration.
- Brainbot, an mHealth app, offers a potential solution by supporting individuals in managing PPCS symptom triggers and re-engaging in daily activities.

Objectives

1. Evaluate Brainbot's usability for individuals living with persistent post concussion symptoms.
2. Identify patterns of user engagement behaviour with the app.
3. Identify factors underlying user engagement behaviour.

Methodology

Design Mixed methods-concurrent nested design.

Participants (N=20)

- English speaking individuals
- Aged 18-64 years
- Self-reported dx of concussion
- >4 weeks post-injury
- >1 concussion symptoms
- Difficulty with >1 daily activities

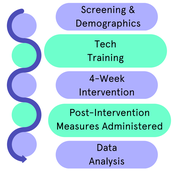
Measures

- Brainbot data: planned and logged activities (activity name, activity points, duration, date, time, symptom emoji), SCAT-5 symptom list, and free-form notes.
- Modified System Usability Scale (mSUS)
- Semi-Structured Interview

Analysis

- mSUS and user engagement data was analyzed using descriptive statistics.
- Participants were grouped by user type.
- Qualitative data analysis is underway.

Procedure



User Groups

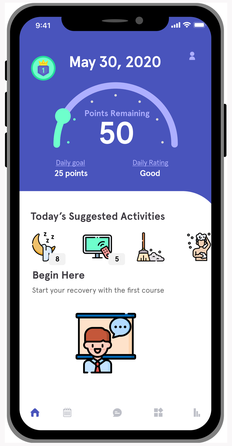
Non-User	<5 days logged during intervention
Casual	5-15 days logged during intervention
Periodic	16-25 days logged during intervention
Dedicated (Unemployed)	>25 days logged during intervention & unemployed status
Dedicated (Employed)	>25 days logged during intervention & employed status

Intervention

Participants received training on how to use the Brainbot app and were asked to use it over a period of 4 weeks (28 days). They were given the freedom to use the app in any manner they wished.

Features available for use:

- Points-based activity pacing framework for activity and symptom tracking
- Proprietary algorithm to adjust point levels weekly
- Data Insights
- Educational resources: psychoeduation, symptom management, improving occupational performance, etc.



Results

Demographics

95%	27	42.1
Female	Avg Time (mos) Since Injury	Avg Age (yrs)
N=19	Range: 2-85	Range: 25-63

Modified System Usability Scale

69.6

Average mSUS Score
> Standard Benchmark (68)

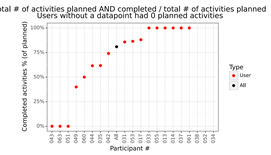
The mSUS results yielded an average score of 69.6 (range = 47.5 - 92.5), exceeding the standard benchmark of 68. This indicates an average level of usability and marginally high acceptability, positioning it comparably with mobile health apps used in managing various chronic health conditions.

User Engagement

Figure 1. Activity recording spikes at 8am & 8pm

Figure 2. Most participants did not plan activities

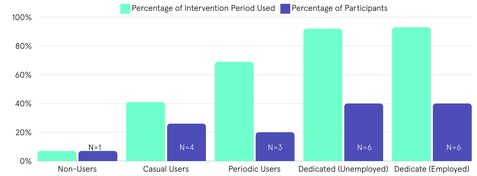
Figure 3. When participants plan, they tend to follow the plan



Engagement by User Group

During the intervention period, app usage among the five groups was as follows: 7%, 41%, 69%, 92%, and 93%. Additionally, 75% of participants (N=15) utilized the app to track activities and symptoms, averaging 6.15 days/week (range = 4.5-7 days/week).

Figure 4. Types of Users & Engagement



Discussion

It's Usable!

- Achieved the usability benchmark of 68, showing promise as a mobile health tool for self-management of concussion.

User Engagement Analysis for Feature Refinement

- Activity logging peaks at 8 am and 8 pm, suggesting influence from daily routines or app notifications, warranting further investigation to evaluate the impact of notifications.
- The planning feature, aimed at facilitating pacing and energy conservation, was under utilized (<10% of activities planned) despite a high completion rate (82%) when used. Further study would inform how Brainbot could support activity planning, an evidence-based self-management strategy for PPCS,

High Engagement

- User engagement rates varied (7%, 41%, 69%, 92%, 93%), highlighting the importance of individual factors like motivation and symptom severity on app usage.
- 75% of users engaged with the app for an average of 6.15 days/week, demonstrating its value and utility.
- The consistent engagement underscores the app's potential as a valuable healthcare tool. Leveraging app data could offer healthcare providers deeper insights into patient behaviors and symptoms for enhanced treatment planning.

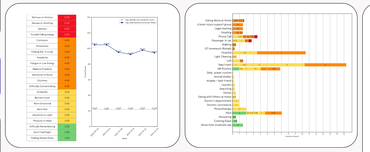
Limitations & Future Research

- Limitations included a low sample size and a predominantly female participants due to convenience sampling.
- Future studies should aim for a more diverse and larger sample to overcome these limitations.

New Features

Based on study findings, new features have been developed, including:

Figure 5. Sections of the Weekly AI-Powered Insight Reports



Worst Symptoms This Week
Fatigue, Noise Sensitivity, Headache

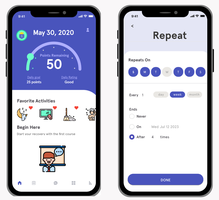
Most Challenging Activities
Sexual Activity, Active Childcare, Biking

Best Activities
Meditation, Pet Care, Family Time

AI-Generated Insights

It looks like grocery shopping was tough today. Consider going when it's not busy, limiting your trip to 30 minutes, and wearing sunglasses and musician ear plugs to reduce symptoms.

Figure 6. Favorite & Repeat Functionality



Watch the 5-min Demo Video!

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