FitWisdom usability results from YMCA users: A PLS-SEM Analysis

Lalitha Pranathi Pulavarthy BDS [1], Kevin Chen, BDS [1], Saptarshi Purkayastha, PhD [1], Navin Kaushal, PhD ,
[1] Indiana University Indianapolis, Indianapolis, IN, USA

Background

Regular physical activity is vital for health, yet adherence remains challenging due to motivational barriers, time constraints, and difficulty finding personalized exercises. Most existing exercise apps rely on generic recommendations and lack clinical integration. FitWisdom addresses these limitations through a clinical evidence-based recommender system that integrates clustering-based user profiling, reinforcement learning (Multi-Armed Contextual Bandit), and explainable AI to deliver personalized, clinically safe exercise guidance with behavior-change theory-driven rewards.

Objectives

This study evaluates the usability and perceived usefulness of FitWisdom using the validated Health-ITUES framework. We aimed to understand how Ease of Use and User Control influence perceived Impact, and how Impact subsequently affects Perceived Usefulness. Additionally, we examined potential mediation and moderation pathways between these constructs to identify key drivers of user adoption and engagement in personalized exercise applications.

Research Design

We conducted an explanatory sequential mixed-methods usability study with 32 adult participants recruited from YMCA Indianapolis. The study was approved by the Indiana University Institutional Review Board (IRB #26736).

Participants (n=32) had a mean age of 33.41 years (±13.7) with 75% male and 22% female representation. The sample was racially diverse (50% White, 25% Asian, 12.5% Black/African American, 9.3% Other) with varied exercise app experience (see Figure 1).

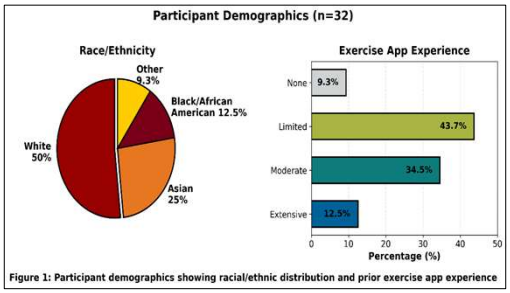
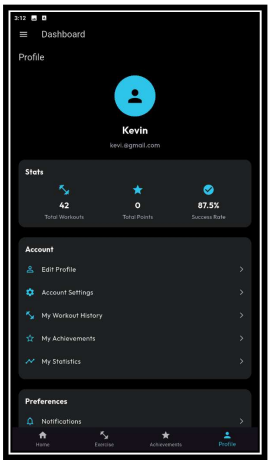


Figure 1: Participant demographics showing racial/ethnic distribution and prior exercise app experience

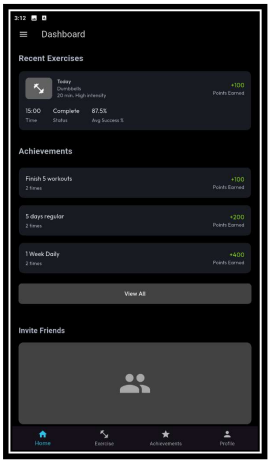
Data Collection: Participants completed a 21-item Health-ITUES survey (5-point Likert scale: -2 to +2) measuring Ease of Use, User Control, Impact, and Usefulness. They then completed five supervised app tasks using think-aloud protocol: onboarding, workout initiation, program review, progress tracking, and profile viewing. Sessions were video recorded and transcribed.

Analysis: Quantitative data were analyzed using PLS-SEM with 1,000 bootstrap iterations (R/SEMinR package). Construct reliability was assessed using Cronbach's α, Composite Reliability, and AVE (thresholds: ≥0.70, ≥0.70, ≥0.50). Qualitative data underwent iterative thematic coding with intercoder reliability established between two researchers.

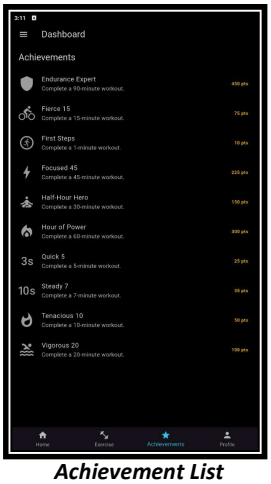
FitWisdom Key App Features



User Dashboard



Progress Tracking



Achievement List

Results

Quantitative Findings:
The PLS-SEM analysis demonstrated strong explanatory power, accounting for 44.1% of the variance in Impact (R^2 = 0.441) and 71.4% of the variance in Usefulness (R^2 = 0.714). All constructs exhibited acceptable reliability, with Cronbach's alpha values ranging from 0.565 to 0.788, composite reliability from 0.795 to 0.877, and AVE values from 0.504 to 0.705. Using 1,000 bootstrap iterations, path analysis revealed that Ease of Use significantly predicted Impact (β = 0.460, t = 2.771, p = 0.006), as did User Control (β = 0.323, t = 2.168, p = 0.030). Impact in turn strongly predicted Usefulness (β = 0.445, t = 3.321, p < 0.001).
These results support the mediation pathways from Ease of Use and User Control to Usefulness through Impact. For moderation effects, Impact × Ease of Use approached significance (β = 0.363, t = 1.833, p = 0.067), while Ease × Control was not significant (β = 0.216, t = 1.490, p = 0.136). Covariate analyses indicated that Age had a direct positive effect on Perceived Usefulness (β = 0.522), while Gender showed a negative path coefficient to Perceived Ease of Use (β = -0.257), suggesting females perceived lower ease of use than males.

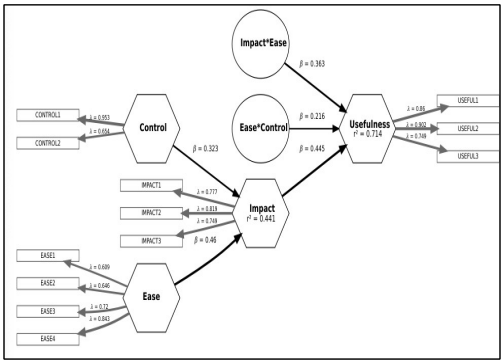


Figure 2: PLS-SEM model of Health-ITUES survey

Qualitative Findings: Qualitative analysis revealed four themes (see Figure 3): Ease of Use - onboarding manageable but self-categorization confusing; Usefulness - potential recognized but value versus existing apps uncertain; User Control - customization valued but feature discoverability challenging; Impact - tracking clarity shaped workout quality.

Figure 3: Qualitative themes from think-aloud usability sessions (n=32)

Conclusion & Future Plans

The Health-ITUES framework effectively captured usability relationships where Ease of Use and User Control influence Usefulness via Impact (R^2=0.714). Workout quality and visual appeal drive user satisfaction, demonstrating that usability improvements must enhance perceived system impact to drive adoption. Key design recommendations: simplify onboarding, enhance feature discoverability, strengthen progress tracking, and add tutorial support. Future work will expand to larger diverse populations, examine long-term engagement, and integrate objective usage metrics with self-reported data to inform iterative design improvements.

References

1. Naliyatthaliyazchayil P, Pemmasani D, Kaushal N, Nemati D, Purkayastha S. Personalizing exercise recommendations with explanations using multi-armed contextual bandit and reinforcement learning. CEUR Workshop Proceedings. 2024;3823.

2 .Schnall R, Cho H, Liu J. Health Information Technology Usability Evaluation Scale (Health-ITUES) forUsability Assessment of Mobile Health Technology: Validation Study. JMIR Mhealth Uhealth. 2018;6(1):e4.doi:10.2196/mhealth.8851