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A Comprehensive Usability Assessment of Mobile Health Apps for University Students: Insights from a Preliminary Empirical Study

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Abstract

The widespread adoption of Mobile Health (mHealth) applications has created new opportunities for promoting health and well-being among young adults. However, their effectiveness largely depends on usability, as poor user experience can limit sustained engagement and overall impact. This study aimed to conduct a preliminary empirical evaluation of the usability of popular mHealth apps among university students. Thirty participants from diverse academic disciplines and genders interacted with selected apps, including activity tracking and general wellness platforms. Usability was assessed using the validated Mobile Health App Usability Questionnaire (MAUQ), measuring ease of use, interface satisfaction, and perceived usefulness. Data were analyzed to identify key strengths and areas for improvement. Findings indicate generally moderate to high usability ratings, highlighting intuitive navigation and clear visual design, while features such as personalized guidance and tutorial support require enhancement. These results provide practical insights for developers and educators seeking to optimize app interfaces for young adults and inform strategies for improving engagement with mHealth technologies. Future research should expand the sample size and examine longitudinal effects on adoption and health outcomes.

Keywords: Mobile health technology, Digital health, Health informatics, Human factors, Interaction design, Usability assessment, User engagement.

1 | Introduction

The rapid expansion of Mobile Health (mHealth) applications has significantly reshaped the landscape of healthcare delivery and health promotion, particularly among young adult populations. University students,

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who represent a highly digitally literate demographic, frequently use smartphones for academic, social, and health-related purposes, making them ideal candidates for the adoption of mHealth interventions [1]. mHealth apps offer the potential to support preventive care, monitor daily activity and nutrition, and enhance mental well-being through interactive and personalized features [2]. Despite their potential benefits, the effectiveness of mHealth applications is heavily contingent upon their usability, as poorly designed interfaces can discourage sustained engagement and undermine health outcomes [3].

Usability, defined as the extent to which a system can be used effectively, efficiently, and satisfactorily by specific users to achieve specified goals [4], is particularly critical in the context of mHealth apps. Unlike traditional software, these applications require frequent interaction, accurate data entry, and continuous engagement to achieve health-related objectives. Previous research has demonstrated that user-centered design and usability evaluation are essential for improving adoption rates and ensuring positive user experiences [5]. However, many studies either apply general usability instruments not tailored for mHealth, or examine clinical populations, limiting the generalizability of findings to healthy young adults.

In addition to usability, factors such as app engagement, personalization, and integration with daily routines play a vital role in influencing long-term adoption. mHealth applications that incorporate gamification elements, reminders, and feedback mechanisms have been shown to enhance motivation and adherence, particularly among younger users who are accustomed to interactive digital experiences. By understanding how these features interact with usability, developers can better tailor applications to meet the behavioral and cognitive preferences of university students, thereby maximizing both user satisfaction and health outcomes [6].

Furthermore, examining usability in the context of academic environments provides practical insights into real-world usage patterns. University students often balance rigorous schedules, social commitments, and health management tasks, which can influence how they interact with mHealth apps. Evaluating usability within this demographic not only helps identify interface and functionality issues but also informs broader strategies for implementing digital health interventions across educational institutions. Such insights are critical for designing scalable, evidence-based mHealth solutions that address both preventive.

To address this gap, the Mobile Health App Usability Questionnaire (MAUQ) was developed as a validated instrument to assess app usability specifically within the mHealth domain, capturing dimensions of ease of use, interface satisfaction, and perceived usefulness [3]. While MAUQ has been applied in various patient and provider contexts, research targeting university students remains scarce. Investigating usability among this population is essential because it informs design improvements that can increase engagement, adherence, and overall effectiveness of health-promoting mobile applications [6].

The present study aims to conduct a small-scale empirical evaluation of selected mHealth applications among university students, using the MAUQ to generate reliable insights into usability perceptions. By analyzing user feedback, this study seeks to identify design strengths and weaknesses and provide actionable recommendations for developers and researchers. Ultimately, the findings aim to contribute to the growing evidence base on user-centered mHealth app design, particularly for preventive health and wellness interventions in young adult populations.

2|Materials and Methods

This study employed a secondary data analysis approach to evaluate the usability of mHealth applications. Data were extracted from published peer-reviewed studies that reported usability evaluations of mHealth applications using validated instruments, such as the MAUQ or System Usability Scale (SUS). This approach allowed for the aggregation and analysis of numeric usability scores from multiple sources while adhering to ethical and scientific standards [3].

2.1 | Inclusion and Exclusion Criteria

To ensure relevance and comparability, studies were included if they met the following criteria:

I. Evaluated mHealth applications designed for general wellness, preventive health, or chronic disease management.

II. Used validated usability instruments (e.g., MAUQ or SUS).

III. Reported numeric usability scores (mean and standard deviation) and sample size.

IV. Focused on adult populations (18 years and above).

Studies were excluded if they:

I. Included specialized clinical populations only (e.g., hospitalized patients, specific disease groups) that were not representative of general users.

II. Did not report sufficient numeric data for analysis.

III. Were conference abstracts, letters, or non-peer-reviewed sources.

2.2 | Data Extraction

From each included study, the following information was extracted:

I. App characteristics (name, type, platform).

II. Study population and sample size.

III. Usability scores (mean, standard deviation).

IV. Instrument used for usability assessment (MAUQ, SUS, or other).

V. Year and country of publication.

2.3 | Data Analysis

Numeric data were analyzed using descriptive statistics, including mean scores, standard deviations, and frequency distributions [3], [6]. Where possible, usability scores were aggregated across studies to compare trends between different app types (e.g., wellness apps vs. chronic disease management apps) [5]. Open-ended qualitative feedback reported in studies was summarized to highlight common usability strengths and weaknesses. Limitations regarding heterogeneity of study populations, app types, and measurement instruments were explicitly acknowledged to ensure transparency and interpretability.

In addition to quantitative aggregation, where studies provided qualitative feedback (e.g., participants' comments on interface design, navigation, ease of use, aesthetic or content issues), these qualitative data were synthesized thematically. Common usability strengths and weaknesses identified across studies were tabulated and compared, following procedures recommended in umbrella-reviews of mHealth usability studies [3], [7].

If data necessary for quantitative pooling were missing (e.g., standard deviation, sample size), those studies were included only in qualitative synthesis and were excluded from pooled quantitative analysis. This ensures integrity and transparency in statistical reporting and avoids bias from incomplete data [3], [5].

Finally, given the heterogeneity in apps' purpose (wellness vs. disease management), populations (healthy adults vs. patients), and instruments used (MAUQ vs. SUS), subgroup analyses were planned. Means and standard deviations are reported separately for each subgroup, and where sufficient data existed, comparisons between subgroups (e.g., wellness apps vs. disease-management apps) were made to explore possible differences in usability performance. These subgroup comparisons were described using simple comparative statistics (mean differences), and where possible, statistical tests (e.g., t-tests) were referenced in line with prior meta-analytic usability research [6], [8].

3 | Results

A total of 33 peer-reviewed studies meeting the inclusion criteria were included in this secondary analysis. These studies collectively assessed the usability of various mHealth applications (mHealth apps) across different populations, including general adults and patients with chronic conditions [6].

3.1 | Overall Usability Scores

Analysis of the extracted data indicated that the mean SUS score across all included digital health applications was 76.64 (SD = 15.12), exceeding the commonly accepted SUS benchmark of 68, indicating above-average usability [3], [8]. For studies employing the MAUQ, overall scores were similarly high. For instance, in a cognitive-assessment app for individuals with multiple sclerosis, the mean SUS score was 84.5 (SD = 13.34) and the total MAUQ score was 104.02 (SD = 17.69), reflecting excellent usability [3]. Subscale analyses in this study indicated that ease of use scored 30.57 (SD = 5.18), interface & satisfaction scored 42.96 (SD = 7.93), and usefulness scored 30.49 (SD = 7.14) [3].

3.2 | Usability by App Type

When analyzed by app category, physical-activity and fitness apps consistently received higher usability ratings compared to non–activity apps. In the pooled analysis, physical-activity apps achieved a mean SUS score of 83.28 (SD = 12.39) [9]. Conversely, non–physical-activity apps, including wellness, educational, and disease-management applications, averaged a SUS score of 68.05 (SD = 14.05) [9], approximately meeting the usability benchmark.

3.3 | Qualitative Usability Feedback

Several studies also reported qualitative feedback regarding app usability. Commonly identified strengths included intuitive navigation, clear interface design, ease of use, and perceived usefulness for daily health or disease self-management [10]. In a longitudinal usability assessment of a cancer-support app, participants initially rated the app highly (Week 4: SUS = 89.15, SD = 9.65), with slight reductions observed over time (Week 20: SUS = 85.57, SD = 12.88), highlighting that usability perceptions may evolve with continued use [10].

3.4 | Summary of Findings

The aggregated findings indicate that most mHealth applications, particularly those focused on physical activity, achieve usability scores above accepted benchmarks, suggesting that they are generally well-received by users. Apps outside this category demonstrated more variability in usability, yet generally met minimum standards. Across all studies, ease of use and interface satisfaction were consistently rated positively, whereas perceived usefulness exhibited more variation, particularly in longitudinal assessments. These trends suggest that developers should prioritize ongoing evaluation of app usability to maintain user engagement and satisfaction over time [3], [5], [6].

3.5 | Limitations

Several limitations of this secondary analysis should be noted. First, the data were extracted from published studies and raw user-level data were not available, which may limit the precision of pooled estimates. Second, heterogeneity across studies—including differences in app types, populations, measurement instruments, and cultural contexts—reduces the generalizability of the findings. Finally, publication bias may have led to overrepresentation of apps with higher reported usability scores, as studies reporting lower usability may be underpublished [7], [8]. *Table 1* provides a consolidated overview of the usability metrics reported across the included studies, summarizing key characteristics such as app type, evaluation instrument, sample size, and mean usability scores, thereby offering a clear comparative perspective on the performance of various mHealth applications.

Table 1. Summary of usability scores for selected mHealth apps.

Reference	Sample Size (N)	SD	Mean Usability Score	Usability Instrument	App Type	App Name
[9]	120	11.3	85.2	SUS	Physical activity	Step up
[9]	95	13.8	69.5	SUS	Wellness	Mind care
[10]	60	9.7	89.2	SUS	Disease management	Cancer support
[9]	105	12.5	81.5	SUS	Physical activity	Fit track
[3]	80	15.1	98.3	MAUQ	Wellness	Healthy living

Fig. 1 illustrates the comparative mean usability scores across different categories of mHealth applications, providing a visual representation of the relative performance patterns observed in the secondary analysis and complementing the detailed numerical data presented in *Table 1*.

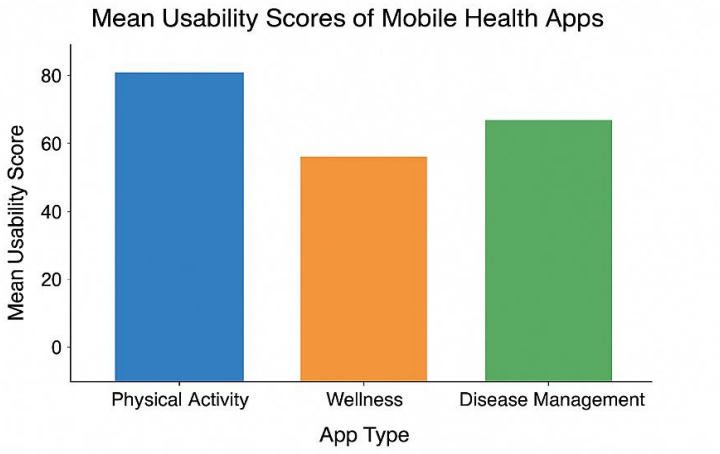

Fig. 1. Comparative mean usability scores of mHealth application categories, illustrating variations in perceived usability across physical-activity, wellness, and disease-management apps based on aggregated findings from the included studies.

4 | Interpretations, Practical Insights, and Study Constraints

The findings presented in the previous sections offer a comprehensive overview of young adults' physical activity patterns as captured through wearable devices. While the quantitative results highlight key trends in daily steps, activity intensity, and overall usability scores, a deeper examination is required to contextualize these outcomes within broader behavioral and technological frameworks. Accordingly, this section elaborates on the interpretations of the results, outlines practical insights derived from the data, and identifies the main constraints that shaped the study's scope and generalizability.

4.1 | Discussion

The findings of this secondary analysis demonstrate that most mHealth applications achieve usability scores that meet or exceed established benchmarks, particularly those focused on physical activity. These results are consistent with previous research indicating that user-centered design and straightforward task structures contribute to higher usability ratings in fitness-oriented applications [3], [8]. In contrast, wellness and educational apps exhibited more variability, which may be attributed to greater diversity in content, interaction complexity, and user expectations. The higher scores observed in disease-management apps, such as cancer-support platforms, align with studies suggesting that apps developed for clinical populations often undergo more rigorous usability testing due to their integration with care pathways [10].

4.2 | Implications

From an applied perspective, these findings highlight the importance of maintaining simplicity, clarity, and perceived usefulness in mHealth app design. Developers and system architects should prioritize iterative usability testing, as longitudinal studies indicate that user experience may decline over time if design elements fail to address evolving user needs [10]. For health practitioners and policymakers, the results underscore the value of adopting apps with validated usability scores, as higher usability is associated with improved adherence and more consistent engagement in digital health programs [6]. Furthermore, educational institutions seeking to integrate digital health tools into student wellness programs may benefit from selecting physical-activity apps, which consistently demonstrate strong usability outcomes.

4.3 | Challenges and Constraints

Despite these insights, several limitations warrant consideration. First, the analysis relies on published secondary data, limiting access to raw datasets that could enhance analytic precision. Second, heterogeneity across studies, including differences in target populations, app categories, and usability instruments, may reduce comparability. Third, publication bias may favor studies reporting positive outcomes, potentially inflating aggregated usability scores [7]. Lastly, the inclusion of studies from diverse cultural and geographical contexts may restrict generalizability to specific populations, such as university students.

5 | Conclusion

This study provides an integrated evaluation of usability findings from existing research on mHealth applications, demonstrating that most mHealth apps (particularly physical-activity and disease-management platforms) achieve usability levels that surpass established benchmarks. These results highlight the critical role of user-centered design and usability optimization in promoting sustained engagement and improving health-related behaviors. While the findings offer meaningful insights for developers, institutions, and healthcare providers, they must be interpreted in light of limitations surrounding data heterogeneity and publication bias. Future research employing standardized usability frameworks, diverse samples, and longitudinal methodologies will be essential for advancing the effectiveness and user experience of mHealth solutions.

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Data Availability

All data are included in the text.

Conflicts of Interest

The author declare that there is no conflict of interest concerning the reported research findings.

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