

A Social Support-Enabled Mobile Health (mHealth) Application for Adolescents: Is It Usable and Feasible?

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ABSTRACT

This paper presents a step-by-step usability and feasibility assessment of an iteratively and incrementally refined rule-based and evidence-based professional and peer social support-enabled mHealth application with school-going adolescents, mental health counsellors, and a moderator over a 4-week period. The critical analysis of both quantitative and qualitative results indicated a positive reception, with participants expressing appreciation for the app's usability and potential impact on their well-being.

Keywords: Mobile health, Social support, Usability, Feasibility, Adolescent well-being

INTRODUCTION

As of 2024, 15% of the world population is affected by mental disorders with the onset in adolescence (Solmi et al., 2022; Moitra et al., 2023). Depression, a leading cause of morbidity and mortality in this age group is associated with distress and long-term impacts on daily life, increasing the risk of other mental and physical illnesses transitioning into adulthood (Verboom et al., 2014). Early detection and treatment can prevent severe consequences, yet a significant gap exists between the supply and demand of adolescent mental health services (Docherty et al., 2017).

With over 90% of adolescents owning smartphones, mobile health (mHealth) presents a promising strategy for mental health interventions (Dubad et al., 2018). This led HCI researchers to design technologies overcoming barriers to healthcare (Padilla et al., 2015) and incorporate evidence-based treatment components into mHealth applications. However, systematic reviews reveal that most mHealth apps focus on self-help for depressive symptoms and report minimal effect sizes (Grist, Porter and Stallard, 2017; Dubad et al., 2018). These apps are intended to be used in adjunct to face-to-face counselling and often leave 'loneliness,' a core symptom of depression, unaddressed due to limited human interaction (Weisel et al., 2019).

In collaboration with a multidisciplinary team of researchers from psychology and human-centered computing, an evidence-based framework for integrating and incorporating social support from professionals and peers was implemented in the design and development of a mHealth app. This model was constructed through extensive reviews identifying the key theoretical constructs for a social support-enabled mHealth framework (Gilani et al., 2022). The architecture was then refined using two iterative usability evaluation methods: heuristic evaluation focused on the therapeutic process for eHealth interventions (Baumel and Muench, 2016) and a study with technically experienced participants to identify usability issues.

This paper presents the user study conducted with school-going adolescents (peer support), mental health counsellors (professional support) and a moderator to assess the usability and feasibility of the refined mHealth app in a real-world setting. These user-centric findings and their implications can be vital for mobile mental health research and community in making targeted improvements.

METHODS: STUDY DESIGN, PARTICIPANTS & PROCEDURE

The user study targeted adolescents in a school environment in Kuala Lumpur, Malaysia. It was approved by Monash University Research Ethics Committee (Project ID: 23145), which ensured ethical standards regarding consent (self and/or parental), benefits and risks, data collection, retention, as well as confidentiality. Participants had to meet the following criteria: i. be under 19 years old, ii. be familiar with mobile apps and own an Android smartphone, iii. not be receiving mental health treatment, and iv. be able to communicate in English.

The recruitment process began with emailing the research protocol to three local school principals, leading to meeting with one principal and the head of secondary (HOS) who expressed interest. Permissions were obtained for Grade 9–11 students. After securing ethics approval, two in-person briefings were held at the school to explain the app and study details. Students received an explanatory statement to review and were asked to return signed parent/guardian consent forms to the HOS. The app was installed on participants' phones, and at the end of the 4-week study, after briefing, participants completed and returned a questionnaire anonymously to the HOS. As a token of appreciation, participants received a gift voucher.

Participants were provided the social support-enabled mHealth application with an anonymous login to use after school hours. Within the app, they were instructed to complete the Patient Health Questionnaire-9 (PHQ-9) weekly, which assigned them to groups: Group A (score ≤ 9) received peer social support only, while Group B (score > 9) received both professional and peer support. The participants could monitor their depressive score and severity over time via the graph provided. Tasks within the app included: 1. add entries to a daily journal, 2. post and comment on the social media feed. For Group B, 1. send chat messages to assigned counsellor, 2. set up a voice/video call, and 3. provide feedback for the counsellor. Participants were informed regarding the time required for each

task but could spend more time willingly. Within the app, the counselling was confidentially conducted by licensed mental health counsellors, with the option for parental presence during calls.

The recruitment of counsellors was facilitated through a mutual contact (a psychology graduate student) who circulated the research protocol among mental health counsellors meeting two criteria: i. counselling experience with adolescents, and ii. a recognized license to practice. Interested and eligible counsellors were connected with researcher, who selected two counsellors after several meetings. They received the explanatory statement and consent forms, which they returned with e-signatures. During the 4-week study, counsellors used the mHealth app to provide professional support. They had access to current user sessions, depressive symptomatology data, feedback, and a read-only social media feed. At the study's end, counsellors completed an anonymous questionnaire via Google Forms. They were compensated for their time amounting to 1 hour per day x 4 weeks (28 days).

With peer interactions, moderation is a critical aspect within the community to prevent any serious concerns such as cyber-bullying. The moderator had access to all user sessions, depressive symptomatology data, and social media feed. The role of the moderator was to monitor the open peer-to-peer interactions and take action e.g., remove triggering posts and/or comments, though encompassing professional support with peer support is in itself a form of moderation (Ali et al., 2015).

RESULTS & ANALYSIS

82 school-going adolescents were approached for the user study, of which 79 were excluded—61 due to non-Android devices and 18 who declined to participate. The remaining users were asked to complete a questionnaire at the end of the study; the first part to collect demographic details with checkboxes for grade and experience with mobile apps, while age and gender as open-ended responses (see Table 1).

Table 1. The demographic distribution of participants (N = 3).

Participant	Age	Grade	Gender	Level of Experience With Mobile Apps
P1	16	10	Male	Very Experienced
P2	14	9	Female	Very Experienced
P3	14	9	Female	Some Experience

For the counsellors, C1 had a counselling experience of 5.25 years while C2 had 3 years. The experience level with mobile apps was evenly distributed: C2 identified as “Very Experienced,” and C1 as having “Some Experience.”

Reporting Adolescents' Depressive Symptoms

While P1 and P3 completed the PHQ-9 pretest, P3 was lost to the 1-week follow-up and P2 dropped out at the start of the study. Consequently, only P1 completed the user study, taking the PHQ-9 weekly. The data from the study, including peer support interactions, professional support assignments,

journaling entries, PHQ-9 scores, and other miscellaneous data, was securely stored in the Firebase database.

As shown in Table 2, P1 started and ended the user study with moderately severe symptoms, while P3 began with moderate symptoms but dropped out. “Cur_Counsellor” refers to the assignment of counsellors based on the rule-based and evidence-based criteria. Counsellors were rotated to manage workload, given anticipation for a larger participant pool for the user study.

Table 2. The progress report of participants.

Participant	Pretest	W1	W2	W3	W4 [Post-Test]	Cur_Counsellor
P1	13	15	13	17	15	C1
P2	/	/	/	/	/	/
P3	11	/	/	/	/	C2

In addition to the above data, P2 utilized the social media feed for peer support, posting “hello gamer guys” with a relevant visual aid. However, other participants did not comment on the post, making it the only post with no comments during the study. P2 also changed their display picture, which would have been visible to other participants and counsellors on the feed.

Usability Test – SUS & Open-Ended Questions

For the second part of the questionnaire, adolescents and counsellors completed 10 SUS items assessing the application’s necessity and usability (Brooke, 1986). Table 3 presents the score contributions, with “P” for adolescents and “C” for counsellors in response to each item (denoted “I”). The average score for both groups surpassed the benchmark of 68, with adolescents averaging 70.8 and counsellors 93.8.

Table 3. SUS score contribution of adolescents and counsellors.

Participant	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	SUS Score
C1	4	1	5	1	4	1	5	1	4	1	92.5
C2	4	1	5	1	4	1	5	1	5	1	95.0
P1	4	2	4	2	4	2	5	1	5	2	82.5
P2	3	1	5	1	4	/	4	1	3	1	75.0
P3	3	1	4	5	4	1	4	3	2	5	55.0

Lastly, participants were asked 5 open-ended questions to provide insights into their experiences and opinions about the app. The adolescents were asked what they liked and disliked regarding the social support recommendations, while counsellors about their likes and dislikes for the counsellor-client relationship and interactive setup. Both were asked to express their thoughts on the presentation of features and information, overall experience, and suggestions for improvement, including any desired functions or features. Based on thematic analysis, common themes and patterns are detailed subsequently with specific quotes,

highlighting participants' likes, dislikes, mixed feelings, and suggestions for improvements.

Adolescents' Themes

The adolescents appreciated the recommendations provided by the mHealth app, finding them helpful and valuable. They particularly liked the feature for sharing pictures on their feed, even though not all participants used it. This indicates that the core concept of offering social support through the app was well-received.

Theme 1: Effectiveness of Social Support Features

P1: *"The recommendations were really good and helpful."*

P2: *"I can send pictures on my feed for my friends to see."*

P3: *"Though I didn't use the feed, I liked the feature."*

While one participant reported no dislikes, two others found the app somewhat boring due to lack of active users. This suggests that the social interaction aspect of the app was less engaging than anticipated because of its limited user base.

P1: *"I do not have any dislikes."*

Theme 2: Lack of Active Users

P2: *"Not necessarily part of the app but the lack of people joined made it kind of boring and forgetful."*

P3: *"Not many active users."*

The participants found the features and information within the app to be presented in a straightforward and user-friendly manner. They appreciated the simplicity of the design and ease of navigation. However, there may be room for improvement based on 'not too hard' instead of easy-to-use or positively-toned feedback.

Theme 3: App's Intuitive Design and Navigation

P1: *"It was great, straightforward and not too hard to navigate."*

P2: *"They were laid out across the app very clearly."*

P3: *"It was aesthetically pleasing and simple."*

Participants described their overall experience with the app as positive. They found it to be helpful and valuable. Some participants mentioned that they didn't use the app much due to either difficulty in communication (opening up) or understanding the technical-aspect of the feature but still found it interesting.

Theme 4: User Engagement and App Utilization

P1: *"It was great, I found it really helpful and useful."*

P2: *"Pretty okay because I rarely used it but it was interesting."*

P3: *"It was alright but I didn't use it that much because I wasn't sure how to talk to the counselor."*

Participants suggested improvements, including stabilizing the app for smoother performance and adding a notification system to remind users to update their journal or feed. While some participants had specific ideas for enhancing usability, others felt the app was satisfactory as it was, with no further improvements needed.

P3: *"The app is alright on its own."*

Theme 5: Desire for Stability and Notifications

P1: *“The app needs to be stabilized more so it can run smoother.”*

P2: *“Add notification system to remind the user to write in the journal or feed.”*

Counsellors’ Themes

The counsellors appreciated the app’s flexibility, allowing them to be creative with various different activities and tailoring effective chat-friendly interventions. They also valued the ease of use and straightforward communication as positive aspects of the counsellor-client relationship and interactive setup.

Theme 6: Innovative Strategies for Client Engagement

C1: *“Being creative in building rapport with clients through different activities. Being creative in tailoring intervention that is effective and chat friendly.”* Theme 7: App’s Ease of Use

C2: *“It is easy and straightforward to use the app.”*

A counsellor acknowledged the challenge of maintaining client engagement during chat sessions, which impacted the quality of interactions. On the other hand, one counsellor did not find anything they disliked about the mHealth app and its interactive setup, suggesting a generally positive experience in this regard.

Theme 8: Barriers to Active Client Participation

C1: *“...I feel that using mobile app, client is not fully present and focus on the conversation, sometimes client chose to ignore some questions. Sometimes, typing response takes time that further limit the interactions...”*

Theme 9: Satisfaction with Interactive Setup

C2: *“...I did not find anything I dislike.”*

Counsellors found the mHealth app to be generally user-friendly, straightforward and easy to understand, appreciating the mobile app’s design and navigation. However, they provided specific feedback on aspects that could be improved, such as the feed loading time, lack of detail in the chat feature, enabling notifications, and adding a counsellor profile with a content sharing dashboard.

Theme 10: App’s Usability and User-Friendliness

C1: *“Overall, the mobile app is very simple and easy to navigate, user-friendly. However, the feed took longer to load. Lack of detail on the chat feature (no date and time...); I didn’t get notifications of new incoming messages...the mobile app is easy to use and consists of necessary essential features.”*

C2: *“Straightforward and easy to understand.”*

Counsellors commonly described their overall experience with the app as positive. They appreciated the opportunity to provide professional support through the mobile app and found it interesting. One counsellor specifically noted that the app was straightforward and efficient in delivering support.

Theme 11: Effectiveness of In-App Support Provision

C1: *“It has been an interesting experience to be able to provide support through the mobile app. Especially when talking to adolescents which*

requires me to be extra creative in curating questions and interventions that's best suited for mobile app features."

C2: *"I feel that if people need help, it's within their hand. The app is very straightforward, nothing is redundant."*

Counsellors shared their thoughts on how to improve the app with one counsellor suggesting adding details to chat messages, including time and date stamps. They also recommended enabling pop-up notifications for timely message reception. Another suggestion was to add a feature in form of a dashboard or resource tab for counsellors to share content with adolescents which would in turn enhance the app's usability and provision of professional support.

Theme 12: Dashboard for Depressive Symptomatology

C1: *"...Adding resources tab for counselors to add in resources...that is accessible for counselees."*

C2: *"... a dashboard for the counsellor to share some content (for example: tips to deal with anxious feelings"*

Theme 13: Need for Improved Communication and Resources

C1: *"Adding details to the chat bubble (time and date of the message sent); allowing pop-up notifications... download feature to pictures being sent as resources for the counselee..."*

C2: *"I might add a counsellor profile..."*

FINDINGS & DISCUSSION

Though a small sample size may affect generalizability of findings, the analysis, along with the discussion of key themes, has significant implications for both the usability and feasibility of the social support-enabled mHealth app. While there is no consensus on sample size for usability testing, the pioneers of this field suggest that 80% of usability issues can be identified with 4–5 subjects (Virzi, 1992). Moreover, while SUS primarily assesses usability and user satisfaction, it provides insights into feasibility through items like '...I would like to use the app frequently,' indicating the potential for real-world implementation. Additionally, open-ended questions further gauge feasibility, with responses like *"I found it really helpful."*

As shown in Table 2, P1 completed the user study, taking the PHQ-9 at pre-test, W1, W2, W3, and post-test, with scores of 13, 15, 13, 17, and 15, indicating consistently moderately severe symptoms. Since the encrypted chat messages were unanalysable, the counsellor provided a brief summary of their interactions with P1, indicating that the professional support features were effectively utilized by the participant though with no changes to the depressive severity. Firstly, the absence of traditional peer support (in school) and through the mHealth app could be a confounding factor for this result. Since the study took place during holidays, and P1 was not shown to interact on the social media feed given the lack of participants, peer support could have contributed to alleviating the depressive symptoms. Additionally, fluctuations in the PHQ-9 score could be linked to personal events, such as losing and finding a pet, as noted in the journal data.

“I had a daily follow up sessions with the counselee since the beginning. Counselee participated openly throughout the counseling process. We did some activities to help counselee understand emotions and him/herself better. We always engaged using the chat features and few times I sent some resources to the counselee for therapeutic purposes.”

SUS scores range from 0 to 100, with scores above 68 indicating better usability (Brooke, 1986). As shown in Table 3, adolescents had an average SUS score of 70.8, which is above the benchmark and considered good and counsellors had an average SUS score of 93.8, indicating excellent usability (Sauro and Lewis, 2016). While these quantitative scores reflect overall usability, qualitative insights from feedback are crucial for identifying specific issues and areas for improvement (Tullis and Stetson, 2006). Mixed responses from adolescents suggest that some found the app significantly helpful, while others thought it was just okay, though without any negative comments. Counsellors reported a positive experience, with no negative themes emerging from their feedback.

The open-ended questions provided valuable insights, with thirteen key themes and patterns emerging from participants’ responses. Positive themes highlighted a favourable user experience and the app’s potential for providing social support. However, addressing the suggestions is crucial for improving usability and user satisfaction. The following discussion particularly focuses on the challenges encountered during the study design, recruitment process, and in-app improvement suggestions, offering important implications for the HCI community.

The Challenges in Recruiting Adolescent Population

User studies involving adolescents often face challenges like low enrolment and high dropout rates. Contributing factors include participant engagement, usability issues, ethical concerns, and time commitment. Adolescents with their limited attention spans may lose interest in study tasks or app usage over time, and usability issues can lead to frustration and withdrawal. Privacy concerns are also significant, as adolescents may drop out if they feel their data isn’t secure. Additionally, their busy school schedules make long-term participation difficult.

Therefore, it is essential to consider these factors when approaching adolescents for participation. Some of the steps that can be taken are i. design study tasks and interactions to be engaging and aligned with adolescents’ interests and preferences. ii. conduct thorough usability testing to identify and address technical issues and usability barriers before the user study. iii. maintain transparent and clear communication with participants regarding the study’s purpose, data handling, and expected time commitment, iv. offer appropriate incentives or rewards to motivate participants to stay engaged throughout the study and v. encourage participants to provide feedback and address their concerns to maintain their interest and trust. These measures were implemented to mitigate challenges during the user study.

When only 3 adolescents returned the consent forms, students who were willing to disclose were asked to anonymously explain their reasons for non-participation. Many cited not having an Android phone, though some users expressed a desire to participate if they had the right device: *'I don't have an Android phone, else I would have definitely participated.'* Other reasons were lack of interest or time: *'I was not interested in the app'* and *'I have a busy schedule,'* parental restrictions: *'parents weren't interested'*, and stigma around mental health apps *'I don't have a mental problem'* and *'I don't need it.'* These findings highlight challenges in recruiting adolescent population and offer insights into barriers to participation.

The Lack of In-App Adolescent' Participation

Participants' feedback highlighted a key issue: the lack of active users on the social media feed led to boredom and decreased engagement, as expressed by one participant who found it *"kind of boring and forgetful."* This underscores the importance of active users in social features as user-generated content interactions are essential drivers of engagement in such environments. Additionally, two participants did not fully utilize app features like the PHQ-9 or counsellor chat. P2 noted, *"I rarely used it,"* and P3 was unsure how to interact with the counsellor. This correlates with their strong agreement on SUS item I4 regarding usability.

It is noteworthy that participants demonstrated a strong desire to engage in peer support activities within the app. Their feedback revealed a genuine enthusiasm for features like posting and commenting on the feed, highlighting its potential value for connection among adolescents. P2 expressed enthusiasm for sharing pictures on the feed, indicating appreciation for the feature and a willingness to participate in peer-driven interactions. Similarly, P3, despite not using the feed actively, liked the feature, suggesting an interest in leveraging the app's social aspects for support.

This desire for peer support aligns with the role of social media in providing a sense of belonging and support to adolescents (Allen et al., 2014). Adolescents seek validation and advice from peers with similar experiences (Ali et al., 2015). Thus, the social media feed, if cultivated with active users, has the potential to serve as a valuable platform for emotional support and information exchange. Despite limited data from the study, these insights suggest significant implications for the usability and feasibility of the social media feed in mHealth applications.

The Challenges With In-App Client Engagement

A key theme from the counsellors' responses was the challenge of maintaining client engagement in virtual counselling. They noted that clients might not be fully present or focused in the text-based communication, possibly impacting the quality of interactions. Typing responses was also seen as time-consuming, which could affect the depth and speed of interactions, especially in time-limited sessions. This underscores the need for effective communication tools and strategies to facilitate meaningful interactions in virtual counselling settings.

The challenges faced by the counsellors reflect broader issues encountered in digital interventions, especially in mental healthcare. Users often face distractions from other apps or devices, which can affect their engagement (Giordano et al., 2022). Text-based communication in virtual counselling can miss the nuances of face-to-face interactions, such as gestures and expressions, making it harder to convey empathy and rapport effectively (Békés et al., 2021). Moreover, sustaining user motivation over time can be difficult when users are not physically present for sessions. These issues are crucial in mobile mental health research as they impact the effectiveness of counselling and support delivered through apps.

In spite of these challenges, the counsellors were resilient and creative in maintaining full client engagement. They emphasized the need for tailored, chat-friendly interventions, adapting techniques to suit digital platforms. C1's approach to curating questions and interventions highlights the importance of adaptability in virtual counselling. It underscores the counsellor's role in crafting engaging and impactful interventions that resonate with clients in a text-based environment. This creativity is essential to bridge the gap between virtual and face-to-face interactions and to ensure that clients receive the support they need effectively. By addressing these challenges proactively, designers and mental health counsellors can enhance the effectiveness of digital tools for mental health and well-being.

The In-App Improvement Suggestions From Adolescents & Counsellors

Both participant groups provided valuable suggestions for improving the mHealth app. A recurring suggestion from participants was the need for improved app stability, as technical issues like crashes or slow performance can deter regular use. Another significant recommendation was the addition of a notification system, which would serve as a reminder for users to engage with features such as the social media feed or journaling. Timely notifications could encourage consistent use and enhance the effectiveness of mental health tracking.

The counsellors provided valuable suggestions for improving the app such as adding details to chat bubbles, pop-up notifications for timely message reception, a download feature for pictures (within the chat window), incorporating a resources tab for counsellors to share handouts, pictures, and PDFs accessible to counselees, and adding a counsellor profile and a dashboard for counsellors to share content, such as tips for dealing with anxious feelings. These improvements aim to enhance functionality, communication features, and resource-sharing capabilities, making the app a more comprehensive and effective tool for both counsellors and in particular adolescents seeking support and guidance. Researchers can implement these suggestions to help create a more engaging and supportive mHealth app.

CONCLUSION AND FUTURE DIRECTIONS

In this paper, the refined and revised social support-enabled mHealth app was evaluated for usability and feasibility with a moderator, school-going

adolescents, and counsellors for 4 weeks. The participants completed PHQ-9 in the beginning and end of the week for screening and self-monitoring, utilized the social support-features and engaged in expressive writing. The findings from the intervention revealed that the social support aspect of the app was well received, providing evidence for its feasibility. The quantitative analysis revealed acceptability of the app among both adolescents and counsellors, with 13 themes emerging from the qualitative analysis. These insights, along with critical analysis, can inform future research in the mHealth and mental health domains, benefiting mental healthcare providers, app developers, NGOs, policymakers, and funders. The limitations and lessons learned from this user study can guide future research in these fields.

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