Original Article

Think Aloud Testing in Usability Evaluation of the Love Your Breast Application to Enhance Self-Examination Behavior in Adolescents

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Abstract

Background: Adolescents are a key demographic for promoting early breast cancer detection through Self-Breast Examination (SADARI). Mobile health (mHealth) applications offer potential to increase awareness and encourage preventive behaviors, but their effectiveness depends on usability and user experience.
Objective: This study aimed to evaluate the usability of the *Love Your Breast* mobile application using the Think Aloud method and to identify design improvements to enhance its effectiveness for adolescent users.
Methods: A descriptive qualitative design was employed. Ten female high school students in Bandung participated in Think Aloud usability testing, performing seven task scenarios while verbalizing their thoughts. Quantitative data were analyzed through task success rate calculations, while qualitative data were examined using thematic analysis.
Results: The application achieved an average success rate of 86%. Thematic analysis revealed three main usability themes: (1) general observation—issues with font size, color brightness, and background images; (2) performance expectancy—users could not access the video feature; and (3) effort expectancy—some users experienced slow downloads due to poor internet access. Although the app was considered informative and easy to use, these issues negatively affected the overall user experience.
Conclusion: The *Love Your Breast* app shows promise as a tool for adolescent breast cancer awareness and early detection. Future updates should address visual consistency, enable offline video access, and improve performance under limited connectivity. These changes will enhance usability and align with user-centered mHealth design principles, supporting its broader adoption in adolescent health promotion.

Keywords: Usability, Think Aloud, Self-Breast Examination, Adolescents, Breast Cancer

INTRODUCTION

Breast cancer remains the leading cause of cancer-related death among women in Indonesia, with an incidence rate of 42.1 per 100,000 population and a mortality rate of 17 per 100,000 (1). Globally, breast cancer accounts for approximately 2.26 million new cases each year and was responsible for a significant proportion of nearly 10 million cancer deaths in 2020 (2).

While breast cancer can affect women of all ages, a growing number of cases are diagnosed in

younger women, including adolescents(3). Adolescence, defined as the transitional period from childhood to adulthood—typically between the ages of 12 and 21—represents a critical window for education and preventive health behaviors (4) (5,6). Early detection efforts are essential in reducing the risk of breast cancer, particularly through *Self-Breast Examination* (SADARI), which involves observing and palpating the breast to identify any lumps or abnormalities. This method is recommended monthly, ideally on days 7 to 10 after menstruation (7,8).

Despite its simplicity and proven effectiveness, awareness and practice of SADARI remain low. Many women, especially adolescents, lack sufficient knowledge about breast cancer and its early signs, resulting in low motivation to perform regular self-examinations (9,10). Data from the 2016 Non-Communicable Disease (NCD) research revealed that 53.7% of the population had never performed SADARI, and early detection through clinical breast examination (*SADANIS*) in West Java was recorded at only 1.01%, placing it 32nd among 34 provinces in Indonesia (11,12).

With the rapid advancement of technology and the widespread use of smartphones, especially among adolescents, digital health innovations offer promising avenues for promoting breast health education. Many individuals now rely on mobile applications to access information, communicate, and manage health-related concerns (13). Leveraging this technological landscape, we developed a mobile application titled *Love Your Breast* (LOB), designed to increase awareness and knowledge about breast cancer and promote early detection practices.

The *Love Your Breast* application is available on Android-based devices and provides comprehensive educational content, including breast anatomy, tumor classification, steps to perform SADARI, audiovisual guidance, breast cancer treatment options, and information about SADANIS. However, despite its potential, the usability of this application has not yet been formally evaluated.

Usability testing is essential to determine the quality and effectiveness of a digital product from the user's perspective. It focuses on aspects such as ease of navigation, clarity of information, visual appeal, error prevention, and overall user satisfaction (14). One widely used method for usability evaluation is *Think Aloud Testing*, where users verbalize their thoughts, feelings, and difficulties while interacting with an application (15). This method allows researchers to identify usability issues and gain insights into users' cognitive processes during interaction.

In this study, we aim to evaluate the usability of the *Love Your Breast* application using the *Think Aloud* method. Specifically, the evaluation will focus on key usability dimensions including task clarity, efficiency, satisfaction, error identification, and user engagement. The findings are expected to guide improvements to the application's design and content delivery, thereby enhancing its effectiveness as a health education tool for breast cancer prevention.

METHODS

Study Design

This study employed a qualitative descriptive design using the Think Aloud Testing method. This approach involved real-time verbalization by participants while interacting with the *Love Your Breast* (LOB) mobile application, allowing researchers to capture users' cognitive processes, reactions, and challenges during use.

Sample

A total of ten high school students in Bandung were purposively selected to participate in this usability study. The sample size aligns with Ericsson and Simon's (1993) guideline that ten participants are adequate to identify common usability issues in Think Aloud Testing. This is supported by Pratama et al., who emphasized that small samples can effectively reflect user interaction patterns when participants are typical users of the system(16).

Participant inclusion criteria were as follows: willing to provide informed consent, owns an Android-based smartphone, has experience using Android applications, able to express opinions clearly during the usability session.

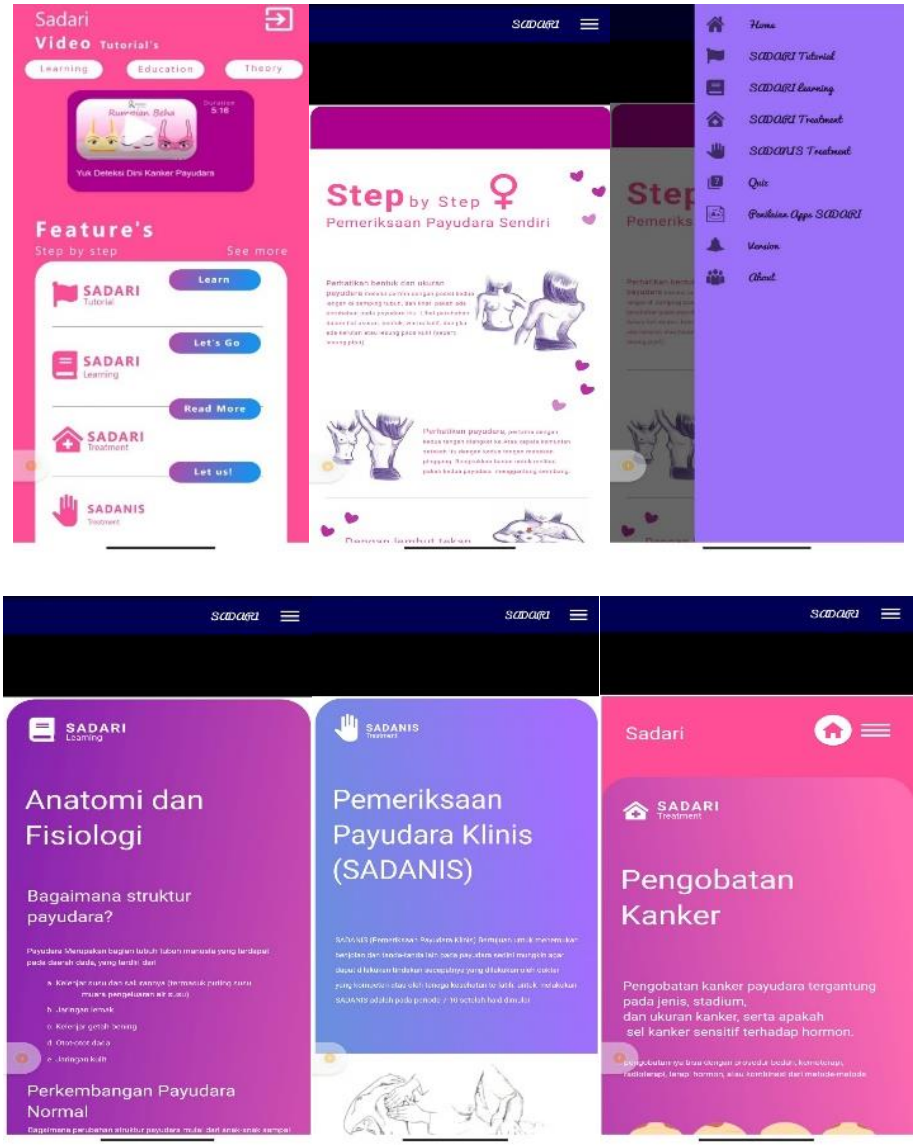
Application Development

The Love Your Breast (LOB) application was developed as an Android-based mobile health tool for breast cancer education and early detection promotion. It was designed by Dian Anggraini to support breast self-examination (SADARI) practices among young women.

The app contains five main features: (1) SADARI Tutorial – step-by-step guidance for conducting

breast self-examination, (2) SADARI Learning – breast anatomy, cancer risk factors, signs and symptoms, (3) SADARI Treatment – information on breast cancer treatment, (4) SADANIS Treatment – procedures for clinical breast examination, (5) Educational Videos – visual content to support self-examination practice.

Figure 1Love Your Breast Application



Ethical Aspects and Research Protocols

This study received approval from the Health Research Ethics Committee of STIKEP PPNI Jawa Barat (Approval No: III/096/KEPK-SLE/STIKEP/PPNI/JABAR/XI/2023). All participants signed an informed consent form before participating.

Participants were then asked to download and use the LOB application while verbalizing their thoughts (Think Aloud protocol). Following the session, participants were interviewed to further clarify their experiences and provide additional feedback.

Research Instruments

The usability testing involved a scenario-based task list that guided participants through key features of the application. While performing these tasks, participants were instructed to verbalize their thoughts, expectations, difficulties, and emotions.

Table 1Task Scenario

No.	Tasks to be done	Yes No
T1	Respondents successfully found the Love Your Breast application that was shared	
T2	Respondents successfully installed the Love Your Breast application	
T3	Respondents successfully logged in or accessed the Love Your Breast application	
T4	Respondents open the menu available in the application	
T5	Respondents easily move from one page to another	
T6	Respondents successfully opened the video feature on the application	
T7	Respondents can return to the main menu list on the application.	

Data analysis

Quantitative Task Analysis

Task performance data were analyzed using effectiveness metrics, where successful task completion was coded as 1 and failure as 0.

The success rate was calculated as follows:

$$\text{Success} = \frac{\text{Number of tasks successfully completed} \times 100\%}{\text{Total tasks}}$$

$$\text{Failed} = \frac{\text{Number of failed tasks} \times 100\%}{\text{Total tasks}}$$

(17).

Qualitative Think Aloud Analysis

Verbal data from the Think Aloud sessions were audio-recorded, transcribed verbatim, and analyzed using thematic analysis. The coding process followed an inductive approach, starting with open coding to identify recurring user expressions, followed by axial coding to group similar patterns, and finally theme development to interpret usability insights. These themes focused on aspects such as: ease of navigation, clarity of content, visual design, task flow efficiency, and user frustration or confusion points.

Triangulation

To enhance validity, triangulation was conducted by comparing the qualitative themes derived from verbal feedback with the quantitative task success rates. For example, verbal expressions of confusion during video access were cross-referenced with task failure rates on T6. This allowed for cross-validation of usability barriers and ensured a more robust understanding of user experience.

RESULTS

This section presents the findings from the Think Aloud usability evaluation of the *Love Your Breast* (LOB) application, aimed at promoting Self-Breast Examination (SADARI) among adolescents. A total of ten female high school

students aged 16–18 years in Bandung participated in this study, conducted in November 2023. Each participant was asked to complete a series of seven predefined task scenarios while verbalizing their thoughts, challenges, and impressions in real time.

Participant Characteristics

All ten participants were adolescent female students who met the inclusion criteria, including familiarity with Android devices and willingness to express their opinions during the session.

Task Completion and Usability Performance

Participants were presented with seven task scenarios to assess the app's navigability, feature accessibility, and overall user flow. The completion results are shown in Table 2.

Table 2Results of Task Scenario Work

Respondent Code	Task Scenario						
	T1	T2	T3	T4	T5	T6	T7
R1	√	√	√	√	√	×	√
R2	√	√	√	√	√	×	√
R3	√	√	√	√	√	×	√
R4	√	√	√	√	√	×	√
R5	√	√	√	√	√	×	√
R6	√	√	√	√	√	×	√
R7	√	√	√	√	√	×	√
R8	√	√	√	√	√	×	√
R9	√	√	√	√	√	×	√
R10	√	√	√	√	√	×	√

As indicated, all participants successfully completed six out of seven tasks. Task 6, which involved opening the educational video feature, consistently failed due to a technical issue in the current version of the application. The video either did not load or was inaccessible, which significantly impacted users' perceptions of completeness and usability.

Tabel 3. Rerformance Measurement Calculation

Respondent Code	Number of Task Scenarios Completed	Number of Task Scenarios Worked On	Success Percentage
R1	6	7	86%
R2	6	7	86%
R3	6	7	86%
R4	6	7	86%
R5	6	7	86%
R6	6	7	86%
R7	6	7	86%
R8	6	7	86%
R9	6	7	86%
R10	6	7	86%

Each respondent achieved a success rate of **86%**, suggesting that the LOB application is generally user-friendly and easy to navigate. However, the consistent failure in Task 6 highlights a crucial functionality gap that needs to be addressed in future updates.

Qualitative Content Analysis

Analysis of verbalizations during Think Aloud sessions revealed three main themes: general observation, performance expectancy, and effort expectancy (Table 4). These themes emerged through inductive coding of participants' verbal responses and post-task interviews.

Table 3Content analysis

Coding	Category	Theme
Uneven font size	Appearance	General Observation
Overly bright colors		
Distracting background		
Video cannot be opened	Application issue	Performance Expectancy
Long download time	Connectivity barrier	Effort expectancy

Usability Feedback and Interpretation

Participants generally expressed positive impressions of the application's purpose and content. Many appreciated its role in promoting breast health awareness. However, several usability issues were consistently reported:

- Video access failure: Participants were unable to open the SADARI educational video. This will be addressed in the next version by embedding a compressed, offline-accessible video format and testing video playback compatibility across Android versions.
- Interface design: Respondents noted inconsistent font sizes, bright color tones, and slightly distracting background images. These design elements will be refined to improve visual comfort, including the adoption of a more neutral color scheme and consistent typography.
- Connectivity concerns: A few users experienced slow download speeds due to unstable internet connections. Future versions will offer a lighter APK size and offline reading options for textual content.

Planned Application Improvements

Based on the usability issues identified through task performance and participant feedback, the following improvements are planned:

1. Fixing the video playback error by ensuring the feature is fully operational and accessible in offline mode.
2. Revamping the visual interface, including consistent font usage, color contrast adjustments, and a simplified background layout.
3. Improving app accessibility, such as optimizing performance on low-bandwidth networks and reducing application size.

DISCUSSION

This section discusses the usability findings of the *Love Your Breast* (LOB) application by interpreting user feedback in light of established theoretical frameworks and principles in mHealth and usability design. Three primary themes emerged from the analysis: general observation, performance expectancy, and effort expectancy. These are synthesized with relevant usability theories to enhance the analytical depth and scientific rigor of the findings.

General Observation: Interface Design and Visual Comfort

Participants provided immediate feedback regarding the visual elements of the application. They reported that overly bright colors, inconsistent font sizes, and distracting background images disrupted the readability and reduced their engagement. These concerns highlight weaknesses in the application's visual hierarchy and information architecture.

From a theoretical perspective, these findings align with user experience (UX) design principles and TAM's perceived ease of use, where poor visual design can negatively influence user acceptance (18). Research by Gresse et al. emphasizes the importance of consistent typography and balanced color schemes in mobile applications to support information retention and sustained interaction (19).

To address these issues, the following design improvements are recommended: (1) Use of harmonious and calming color schemes to improve visual aesthetics, (2) Standardization of font sizes for better text legibility, (3) Reduction of background image opacity to maintain textual clarity. These adjustments are consistent with mHealth design principles, which prioritize

accessibility, simplicity, and clarity in communicating health-related content (2,20).

Performance Expectancy: Feature Accessibility and User Satisfaction

Performance expectancy, as defined by the Unified Theory of Acceptance and Use of Technology (UTAUT), refers to the degree to which users believe the application will help them perform a task effectively. In this study, all participants encountered a consistent usability barrier in Task Scenario 6, where the video feature could not be accessed due to system error.

This technical failure diminished the users' confidence in the application's completeness and undermined its perceived usefulness. Similar issues are frequently reported in mHealth apps where multimedia features are not fully functional or tested across device platforms (21).

To increase perceived usefulness, it is crucial to: (1) Fix video playback issues by embedding offline-compatible formats, (2) Add engaging animated content that improves information absorption and maintains user attention. These updates will enhance the application's alignment with multimedia learning theory and support adolescent engagement by integrating visual, auditory, and textual modalities.

Effort Expectancy: Ease of Use and Technical Accessibility

Effort expectancy, another construct from the UTAUT model, reflects the ease associated with using a system. Most participants reported no issues during the app installation process. However, four users indicated difficulty in downloading the app due to limited internet connectivity, a known challenge in digital health dissemination in low-resource settings.

This finding suggests the importance of developing a lightweight app version or including offline content functionality, consistent with best practices in inclusive mobile health that recommend designing for bandwidth variability (22).

Application Effectiveness: Task-Based Performance Metrics

The usability evaluation yielded a consistent success rate of **86%** across participants, based on performance in task scenarios. According to Pratama et al., this score indicates that the application meets basic usability thresholds but still leaves room for optimization (16).

Although the task success rate is acceptable, user endorsement depends not only on functionality but also on user satisfaction, emotional connection, and perceived trust in the application. These elements are not captured solely through task metrics but are evident in the qualitative expressions gathered through Think Aloud sessions.

To promote adoption, further development should incorporate: (1) iterative user testing with diverse demographic groups, (2) a refined user interface grounded in *user-centered design (UCD)* principles, and (3) continued application of usability heuristics in future design cycles.

CONCLUSION

This study demonstrated that the *Love Your Breast* mobile application, evaluated using the Think Aloud usability method, achieved an effectiveness rate of 86%, indicating a generally positive user experience among adolescent participants. The content analysis revealed three core themes influencing usability: visual design and layout (general observation), feature functionality (performance expectancy), and ease of use in relation to technical accessibility (effort expectancy).

While the application was perceived as informative and easy to navigate, usability limitations—particularly the inaccessibility of the educational video feature and design inconsistencies—undermined the overall experience. These findings offer actionable insights for future iterations of the application. Specifically, feedback from participants will guide the refinement of the user interface (e.g., harmonizing color schemes and font sizes), improvement of video accessibility (e.g., offline-ready media), and optimization for low-bandwidth environments.

Moving forward, these targeted enhancements will be implemented using user-centered design strategies, ensuring that the application is not only technically functional but also emotionally engaging and contextually appropriate for adolescents. Moreover, integrating adolescent feedback throughout the development process will help foster digital health solutions that are both scientifically grounded and behaviorally impactful.

By addressing these limitations, the *Love Your Breast* application holds strong potential to contribute meaningfully to adolescent health promotion, particularly in enhancing awareness and practice of breast self-examination. This aligns with broader mHealth goals of leveraging technology to support preventive health behaviors in youth populations and advancing equity in health information access.

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Author Contributions

DA conceived the study, developed the application, contributed to data collection, data analysis, and manuscript revision.
LR conducted data collection and drafting of the manuscript.
All authors reviewed and approved the final version of the manuscript.

Conflict of Interest Disclosure

The authors declare that there is no conflict of interest related to this study.

Data Availability Statement

The data supporting the findings of this study, including anonymized transcripts of Think Aloud sessions and task performance logs, are available from the corresponding author upon reasonable request via email: dians_23@yahoo.com.

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