The Influence of Human-Centric Design on User Satisfaction and Acceptance in a Malaysian Skincare Mobile Application

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ABSTRACT

Skincare brands, established and local, face significant challenges in attracting and retaining customers in today's highly competitive market. With the growing popularity of digital solutions, leveraging mobile platforms like Android applications offers local brands a unique opportunity to expand their customer base, particularly among younger, tech-savvy demographics. However, the success of such applications depends on their ability to effectively meet the diverse and evolving needs of users. This paper investigates the integration of human-centered design (HCD) principles to enhance user acceptance and improve the usability of a locally developed skincare Android application, Skinterest. A survey was conducted to explore the key factors influencing customer adoption, focusing on the importance of intuitive user interfaces, smooth functionality, and personalized features that cater to individual skin types and preferences. The study provides valuable insights into how HCD can foster trust, satisfaction, and long-term loyalty among users. Positive user feedback, with a 94.6% satisfaction rate, highlights the effectiveness of the Skinterest app in delivering an enhanced user experience.

Keywords— Human-centric design, user acceptance, satisfaction, mobile application development, skincare Android application

INTRODUCTION

In the current digital era, Android applications have become essential elements of daily life, transforming interactions with various services and products [1, 2]. The skincare industry, renowned for its continuous evolution, is no exception to this trend [3]. Malaysian skincare companies are increasingly recognizing the potential of Android applications to enhance their customers' engagement and reach. However, the success of any Android application depends on its ability to associate with its users, making human-centric design a critical factor for its acceptance.

Skincare is the fastest-growing segment in the beauty industry. A study [4] showed that Skincare grew by 13% while makeup grew by just 1% in 2018. Even during the pandemic, while the cosmetic industry has taken a financial hit, the skincare industry has had a positive impact and a boost in awareness towards taking care of the skin. With the abundance of resources nowadays, skincare is becoming more and more complicated. Thus, it could be overwhelming for people to choose the right product suitable for them. Furthermore, there is a lack of understanding about skincare products as well as ingredients and their purposes. Advertisements and social media are too focused on the aesthetics of a product rather than its functions. People tend to get easily influenced by viral products that do not target their specific skin concerns. For example, TikTok as a platform influenced the beauty industry a lot during the pandemic, making many beauty products go viral. With the spotlight always being on foreign products that have many years of good reputation, people tend to turn a blind eye to local products due to a lack of confidence [5]. In addition, there are not many reliable resources that provide sufficient information to compare the local skincare products available in the market.

This paper explores and presents the utilization of human-centric design principles in developing a Malaysian skincare Android application to get better potential customers' perceptions. The primary problem addressed is the challenge faced by skincare brands in Malaysia to create user-friendly and engaging Android applications that cater to the diverse needs and preferences of their customers [6, 7]. As the skincare industry is highly competitive, gaining a competitive edge through an intuitive and customer-centric application is essential. Human-centric design, a user-centered approach to product development, has gained traction in various industries, including technology and Android application development [8]. Its core values focus on understanding user needs, preferences, and behaviors to create intuitive and user-friendly interfaces [9]. Developing a system is straightforward but designing it to focus on human factors and developing it specifically for what is required in daily life makes one system unique and much more successful than others [10]. In the context of skincare applications, human-centric design encompasses tailoring features, content, and user journeys to match the unique requirements and cultural sensitivities of Malaysian consumers.

Following the Introduction, Section II elaborates on the applicability of the human-centric design principles for the skincare android application. This is then followed by the research method in Section III. Section IV presents the results and analysis. Finally, Section V concludes the paper.

THE HUMAN-CENTRIC DESIGN FOR SKINCARE ANDROID APPLICATION

Referring to Landry [11], human-centered design is a problem-solving technique that puts real people at the center of the development process, enabling product creation and services tailored to the customers' needs [12, 13]. Human-centered design is useful because it creates emotional ties [14] with the people that the application is serving while generating efficient products and solutions that meet real-world needs. Generally, human-centered design has three phases [15, 16]. First is the inspiration phase which is dedicated to collecting data on what the customer needs [17]. It emphasizes learning and putting oneself in the target customers' shoes to determine why a new product is needed [18, 19] and what problems they are trying to solve [15]. The second phase focuses on brainstorming ideas from the information gathered [20] during the inspiration phase [15]. Lastly, in the implementation phase, the solution is designed and introduced [15].

By applying human-centric design principles to the development of the Skinterest application, a conducive environment is created. It not only helps in meeting the customers' needs but also engages them on a personal level to ultimately drive customers' acceptance and loyalty.

A. The Human-Centric Elements

This sub-section explains the utilization of human-centric design elements in the Skinterest application to ensure that every aspect of the application is optimized to influence customers' acceptance and engagement.

1. User Interface (UI)

User Interface involves user-friendly visual as well as interactive elements for users to engage with the application. Skinterest has a minimalistic and clean layout that makes it easy for Skinterest users to navigate as well as have a clear understanding of all the features available. Skinterest's UI is designed for simplicity [21], with its horizontal recycler view for the features on the homepage, vertical recycler view for the product recommendation page, easily accessible buttons for adding products to favorites, and a clear side navigation drawer for quick access to all the elements of the Skinterest app. The overall color theme was discussed with some end users to get feedback on which theme was suitable and liked by most of them. All the features were designed using image buttons to make them visually appealing and engaging. For the skin concerns feature, the user can scroll through, and the background color changes for each display to make it more fun and enhance the overall aesthetics of the interface.

2. User Experience (UX)

User Experience (UX) mainly highlights what the user feels when using the Skinterest application which includes user satisfaction, ease of use, and efficiency of the application. User experience (UX) should be given importance as it impacts customer loyalty [22]. Skinterest application focuses on making the local product recommendation

process seamless. Its search filters, brand name search bar, and detailed product listings contribute to a smooth user experience from viewing to searching for products that cater to their skin concerns.

3. Accessibility

Accessibility focuses on design cleverness that welcomes users to use the application [23]. Skinterest application offers a feature for skin cancer analysis where users can upload a picture of skin abnormalities and the application will analyze as well as compare with hundreds of data available to provide results of whether it's cancerous (malignant) or benign (non-cancerous). Skinterest also provides the result with a percentage to show the exact fraction the application calculates the result. Straightforward and easy-to-understand instructions are given for users to upload pictures for analysis. Moreover, Skinterest has a chatroom for all the users to chat with one another. Skinterest utilizes default text size and the font type used is clear to make sure it is comfortable for users to read and write without the need for customization. There is also a good contrast between text and background to aid users with visual impairments.

4. Performance

Performance highlights the experience in the front end. This includes the speed and the app's responses [24]. The Skinterest application has an exceptional performance. For example, when the user is searching product by brand name, the application quickly retrieves search results from its Firebase database and displays them instantly. This shows that the Skinterest application provides users with results within milliseconds. Even for skin cancer analysis, the application provides the results promptly after users upload their skin abnormality.

5. Security and Privacy

The application is made accessible to the specific users only because secured application that protects user data during login is crucial when developing an application related to personal information especially related to someone's face [25]. Skinterest's chatroom focuses on security and privacy. It utilizes end-to-end encryption for the messages, ensuring only the intended user can access them. For the Skinterest app, the chatroom was done based on a personal chat format rather than a group chat format since the majority of end users requested that they felt comfortable sharing skin concerns and recommendations in a one-to-one chat. For Skinterest users, they need to register an account based on their email address and password which will be used for each login. In the case of forgot password, the "forgot password" service will send a link to change password to the registered email only. Thus, only the Skinterest user can view their application details whether it is a chatroom or user profile, or even the products that are added to favorites.

6. Navigation

Navigation for an application refers to how easily users can navigate within the application. Clear navigation is crucial to help users understand where they are within the app and know that there are a variety of navigations to utilize within the app [26]. The Skinterest application has two types of navigation provided. First, is the bottom navigation menu on the homepage with symbols that can be universally understood. For example, a magnifying glass icon was used to represent the search product menu while a heart-shaped icon was used for the favorite menu. The tabs for this bottom navigation menu include "Home", "Notes", "Favorites", "Search" and "Profile", allowing users to switch between different sections seamlessly. The second navigation is the side navigation drawer that includes all the features contained within the app including the logout button. Breadcrumbs are also provided to show users the path they took to the specific page they are currently on. Furthermore, users can directly search products based on the brand name using the search bar provided bypassing the traditional hierarchical navigation.

7. User Education

User education is mainly providing information to users to understand skin concerns, skincare ingredients, and local Malaysian brands better rather than focusing on advertisements and viral products. Skinterest application has seven skin concerns which include "Acne", "Dark spots", "Rosacea", "Vitiligo", "Skin cancer", "Erythema" and "Eczema" where not only information about that particular skin concern is provided but the causes and

ingredients to help with the skin concerns are also provided. Besides, Skinterest showcases all the local brands to provide users with a better understanding of the brands as well as to show support to these exceptional brands.

8. Community and social integration

The community and social integration element allows users to connect and share feedback to encourage user interaction and collaboration [27]. For the Skinterest application, the chatroom feature allows users to click on another user to create a chatroom with them, allowing users to easily share product details as well as recommend products they find effective. Thus, all Skinterest users can communicate with one another creating a community within this application.

9. Personalization

The personalization element focuses on tailoring the user experience based on user preferences [28]. For this element, the Skinterest application includes a filter [29] for the product recommendation feature. Users can filter based on their skin type, product category, skin concerns, and preferences. For example, pregnant users can mark the "Pregnancy-Friendly" checkbox to filter products that are only safe for pregnant women. Users can also add products to their favorites by simply clicking on the heart-shaped icon to add that skincare product to the favorites page. This allows users to customize and view products easily without navigating to the search product page every time they want to view the product they liked.

B. The Skincare Android Application

This sub-section elaborates on the Skinterest modules developed that utilize the human-centric design. It describes the structure and functionality of each module in relation to user interaction. Furthermore, it explains how these modules collectively enhance usability and overall system effectiveness.

1. User Access Module

- User Registration:

Allows new users or unregistered users to sign up for a new account in the Skinterest application. The user is required to fill up all the fields on the signup page with proper credentials and formats.

- User and Admin Authentication:

Allow users and admin to log into the Skinterest application to utilize the features provided. Admin credentials are already set, thus, only the admin knows the credentials. For users, they have to input the correct registered email and password to successfully log into the system.

- Logout:

Allow users to easily log out of the system by clicking on the logout option on the side navigation drawer or through the logout button on the user profile.

- Password Recovery:

Allow registered users who have forgotten passwords to recover passwords by providing the email address that was used during registration.

- User Profile:

Allow users to view their profile details which contain all the information that the user saved during signup.

Skincare Products Module

- Product Recommendation:

Allow users to view all the products systematically, providing the product's name, description (inclusive method to use the product), ingredients, brand, and checkboxes that show what skin type, category, skin concerns, and preferences the product is suitable for. Users can utilize the filter feature to filter based on their skin condition and the system will recommend products based on what the users filtered.

- Favorites:

Allow users to add products to the favorites list. Users can easily access the favorites page to view all the products that have been added.

Notes Module

- Upload Notes:

Allow users to write down any notes about the products or skincare and save them for the future. The notes will be saved in the system.

Skin Cancer Analysis Module

- Cancer Analysis:

Allow users to take pictures of skin abnormalities for the system to analyze and show results. The results show whether the skin abnormality is benign (non-cancerous) or malignant (cancerous) with the guidance of percentage.

Skin Type Questionnaire Module

- Skin Type Result:

Allow users to answer a questionnaire to obtain their skin type results based on the options they have chosen. The system will display a small pop-up menu showing the skin type result.

Communication Module

- Chatbot:

Allow users to ask questions to obtain answers from a chatbot. Users can choose the pre-defined questions and the chatbot will reply with an appropriate answer.

- Chatroom:

Allow all Skinterest users to communicate with each other by having a private chatroom to send messages or to ask for feedback and more.

Information Module

- Skin Conditions Information:

Allow users to get information about skin conditions such as acne, dark spots, rosacea, vitiligo, erythema, dry skin, and cancer. This feature also includes all the treatments available for further reference.

- Brands Information:

Allow users to get information about the Malaysian brands that are available in the application. The information includes the brand's aim to care for the skin and the list of products.

THE METHOD

Figure 1 shows the three main phases of this research: preliminary study, design and implementation, and evaluation.

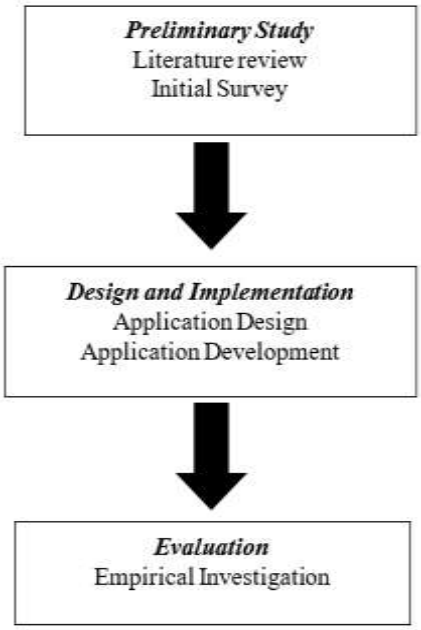

Fig. 1. Research Method Phases

A. Preliminary Study

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Two complementary techniques were employed to obtain insights into human-centric elements for developing a skincare mobile application that benefits users. These techniques comprised a literature review and a survey-based evaluation. The literature review established a foundational understanding of human-centric design elements and their role in enhancing mobile application development. The human-centric elements discussed in Section II were primarily derived from this review. Building on the literature findings, a survey was conducted with a targeted group of users to identify preferred human-centric features in a skincare application. The participants represented active skincare users with prior exposure to Android application development, enabling them to provide informed and constructive feedback from both user and developer perspectives. A functional prototype was provided to allow participants to experience the application prior to evaluation. User feedback was subsequently collected and analyzed from 29 respondents to assess perceptions of the proposed human-centric design elements.

B. Design and Implementation

Based on the feedback gathered during the survey, the Skinterest that incorporated the human-centric design is developed.

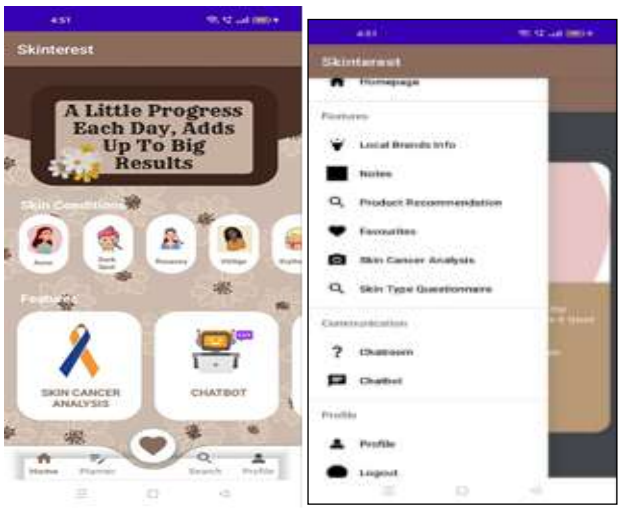

Fig. 2. Navigation Page

Figure 2 shows two types of navigation in this application. The user can access all the accessible pages by choosing and clicking the menu at the bottom navigation bar. This will redirect the user to the page they have clicked. The bottom navigation bar on the user page has the home page, planner, favourites, search, and lastly user profile. Each of these menus will lead to its navigation page when clicked. Furthermore, each of the pages has a side navigation drawer that allows users to navigate through the system smoothly. The ease of use and navigation are the human-centric elements that were included in the app.

Figure 3 displays the user access pages through registration and authentication. Both the user and admin have specific unique credentials set in the application and both types of users have different levels of access. Besides, if the password is forgotten, a small screen will pop up to assist with the password change through email. The security and trust are part of the human-centric element added to these pages.

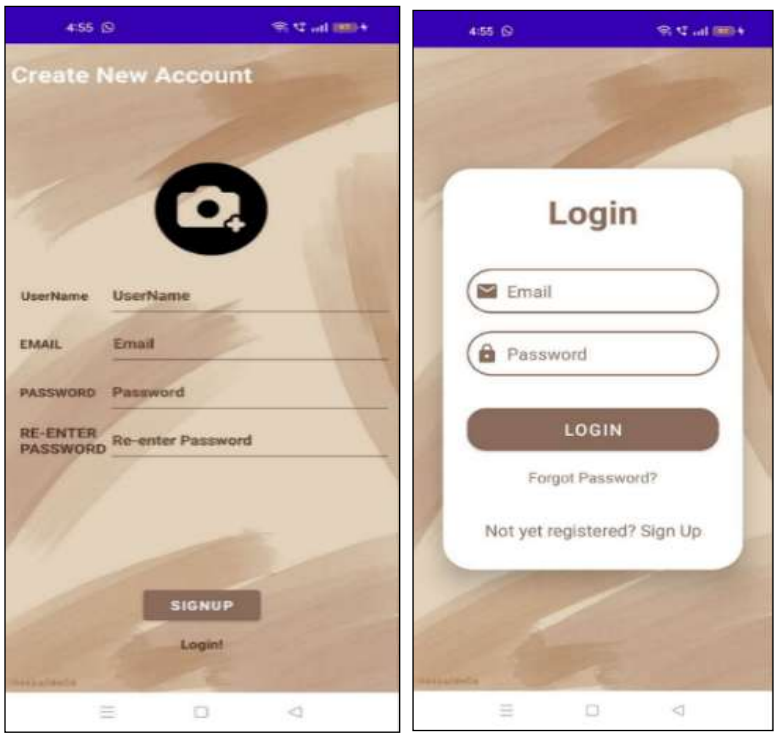

Fig. 3. User Access Page

Figure 4 exhibits the notes page to allow users to insert details about their skincare routine as a planner in a note form. This page resembles the simplicity of uploading notes, making it user-friendly and intuitive.

Fig. 4. Notes Page

Figure 5 shows the skin cancer analysis page. The user can insert an image of skin abnormalities by clicking on the "TAKE PICTURE" button. By doing so, the system opens the device's camera to allow the user to take pictures. The human-centric element is the user-friendly interface and accessibility. This feature provides educational resources within the application.

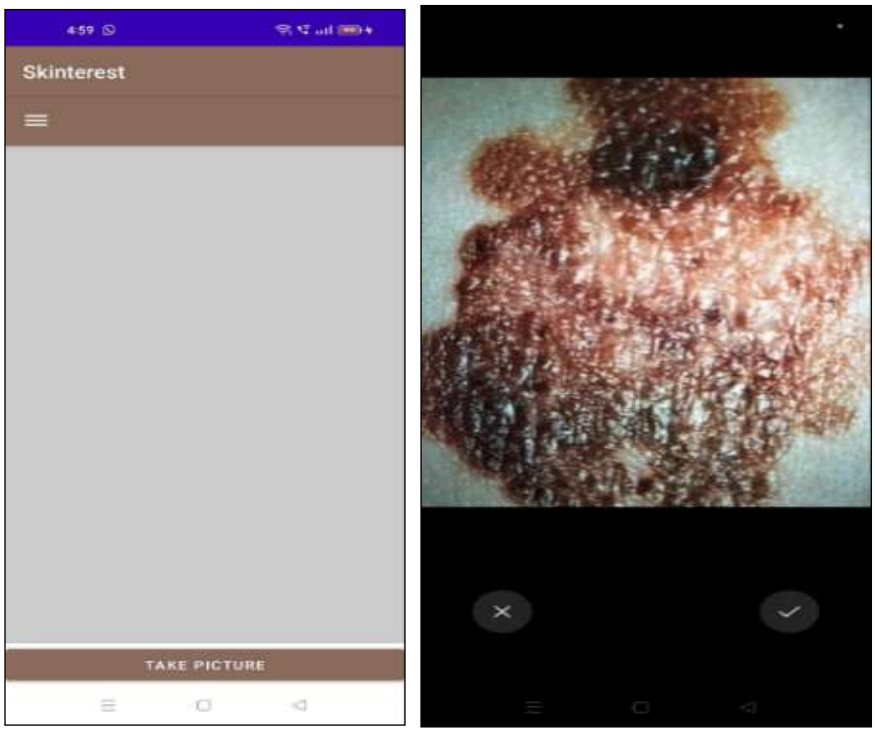

Fig. 5. Skin Cancer Analysis Page

Figure 6 shows the chatbot and the chatroom features. Chatbot allows users to type or choose questions to ask and get responses in return. Assistance and natural language support are the human-centric elements here. Moreover, the user can choose another user from the list of Skinterest users to chat with. This platform is provided to allow peer communication to develop human-centric elements of trust and security. This is an inclusive environment for users from diverse backgrounds to communicate and change information among themselves

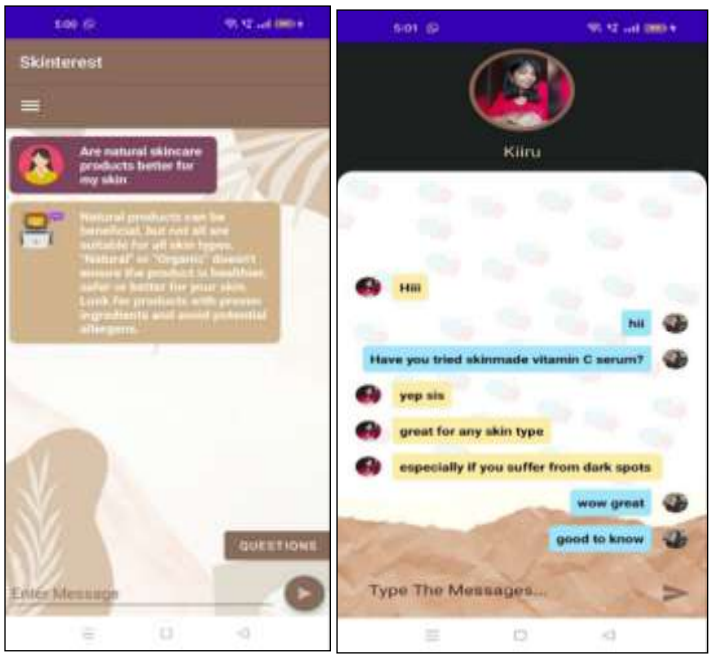

Fig. 6. Chatbot and Chatroom Page

Figure 7 shows the skin type questionnaire page that allows users to get the skin type analysis after answering a series of questions. While Figure 8 displays the product recommendation page from the user dashboard. On this

page, the users could dictate their favourites. These two features display the personalization element in the human-centric design.

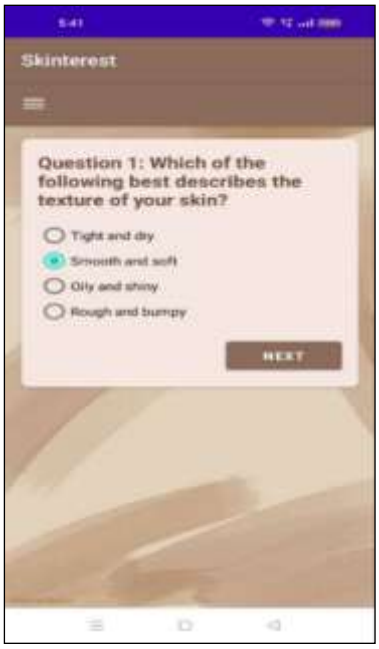

Fig. 7. Skin Type Questionnaire Page

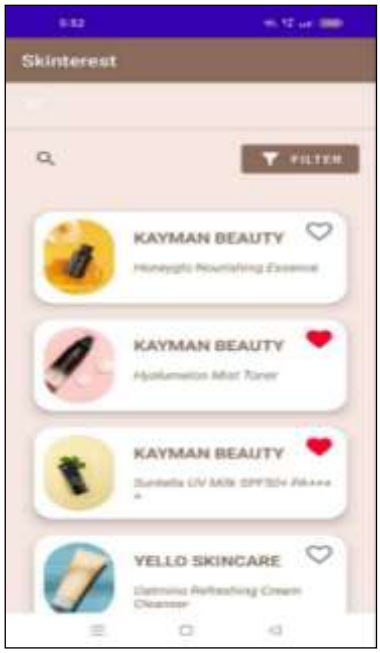

Fig. 8. Add to Favorites Page

C. Evaluation

A simplified empirical investigation was deployed to evaluate the acceptance rate among Skinterest potential users. In the process, the potential users were asked to install and test Skinterest on their own devices to experience the application's functionalities and its usability. There were 74 female potential users (later referred to as respondents) ranging from 19-22 years' old who tested the application on their own devices. Besides, a video demonstration of all the Skinterest functionalities was provided as a secondary reference for the respondents. Then, the respondents were asked to give feedback based on the questions. Except for question 10, the respondents were required to rate every question on a five-point Likert scale; 1 (strongly disagree) to 5 (strongly agree). In question 10, the respondents were expected to provide valuable inputs to enhance the Skinterest further, if applicable. Question 10 allows to improve overall user experience of the application. Listed below are the questions given to the respondents for feedback:

1. How easy is it to use the Skinterest Application?
2. How user-friendly do you find the navigation of the Skinterest application?
3. How accurate do you find the skincare product recommendations provided by the application using the filter option?
4. How helpful do you find the chatbot in addressing your skincare queries?
5. Does having a chatroom to communicate with other users of the Skinterest application help you in sharing product reviews and experiences?
6. Do you find the questionnaire accurate in identifying your skin type?
7. Do you find the skin cancer analysis feature valuable in providing insights on your skin abnormalities, to know whether it's cancerous or not?
8. Does the system handle the error caused by the user by providing "error messages"?
9. Overall, how satisfied are you with the user experience provided by the Skinterest application?
10. Is there any particular feature or functionality you would like to see added or enhanced in the Skinterest Application? How did you enjoy using the Skinterest App?

RESULTS AND DISCUSSION

Based on the empirical investigation conducted with 74 respondents, the analysis shows that the Skinterest application is generally well-received by potential consumers.

A. Descriptive Analysis

Table I shows the number of respondents who scored each of the questions based on the five-point Likert scale and Figure 9 displays the score in percentage. Based on the results, 71.6% of the respondents strongly agreed and 27% agreed that the application is easy to use. Meanwhile, 93.3% strongly agreed and agreed that it is user-friendly.

TABLE I. Respondents' Score Based on Five Point Likert Scale

No.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Easy to use	0	0	1	20	53
2	User-friendly	0	0	5	19	50
3	Product recommendation accuracy	0	1	3	25	45
4	Helpful to address queries	0	0	3	27	44
5	Helpful to share reviews and experiences	0	0	4	20	50
6	Skin type identification accuracy	0	0	6	25	43
7	Analysis features to identify cancerous skin	0	0	5	26	43
8	Provides error handling	0	9	0	0	65
9	User experience satisfaction	1	0	3	13	57

As for the skincare product recommendation accuracy, only 1.4% of respondents disagree and 4.1% score neutral. Therefore, 94.6% agreed that the application provides accurate results based on the filter option. Furthermore, 59.5% of the respondents strongly agreed and 36.5% agreed that the application helps address user queries. It is also 94.6% agreeable that the application helps allow the sharing of users' reviews and experiences.

Regarding skincare analysis to identify skin type, 58.1% of respondents strongly agreed and 35.8% agreed that the application provides accurate identification. Besides, most respondents (91.9%) agreed that the application is valuable in providing insights into skin abnormalities. As for the error handling, 87.85% of respondents are happy with the error handling features embedded in the application while nine respondents (12.2%) are not satisfied. Overall, the Skinterest application is agreeable to providing good features that welcome potential consumers to use the application. The application is easy, user-friendly, accurate, helpful, informative, and capable of handling errors. As for the overall user experience, 94.6% of the respondents are satisfied with the application.

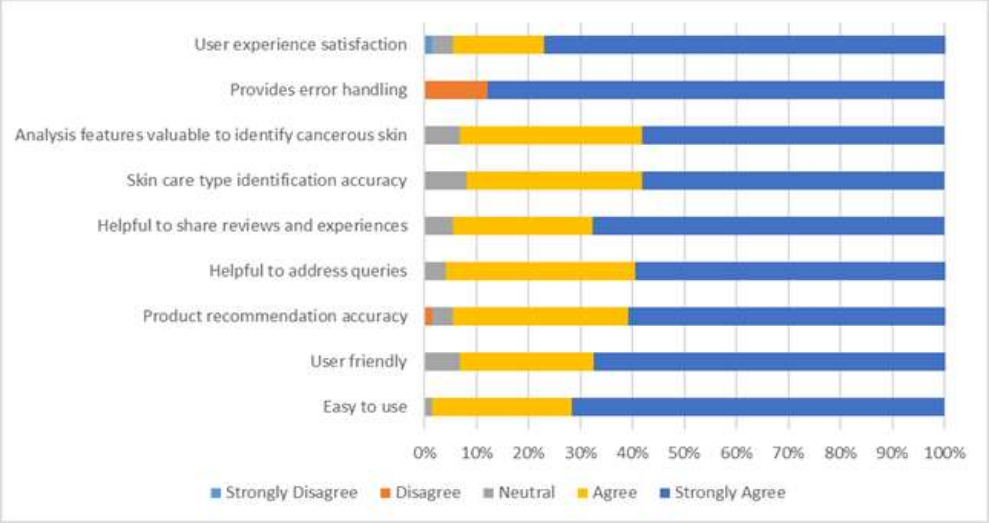

Fig. 9. The Respondents Score in Percentage

Referring to question 10 regarding enhancements for the Skinterest Application and user experience feedback, numerous valuable suggestions were provided. These include AI capabilities such as a face recognition feature for personalization. The application is also suggested to integrate a recommendation system for pricing filters and personalized skincare products to accommodate varying budgets. In terms of usability, it is recommended that the questionnaire screen for skin analysis could fit within a single view using a scrollable interface rather than multiple next buttons. To support the users' decision-making, it is more informative to diversify the range of skincare products to encompass international options alongside local ones. These feedbacks are valuable for researchers working on the same domain to benefit from the human-centric design.

TABLE II. The Mean, Median, And Standard Deviation

No.	Questions	Mean	Median	Standard Deviation
1	Easy to use	4.703	5.000	0.489
2	User-friendly	4.608	5.000	0.615
3	Product recommendation accuracy	4.541	5.000	0.645
4	Helpful to address queries	4.554	5.000	0.577
5	Helpful to share reviews and experiences	4.622	5.000	0.590
6	Skin type identification accuracy	4.500	5.000	0.646
7	Analysis features to identify cancerous skin	4.514	5.000	0.625
8	Provides error handling	4.635	5.000	0.987
9	User experience satisfaction	4.689	5.000	0.681

Further analysis was conducted to comprehend the typical rating pattern and consensus among respondents for each statement based on the mean, median, and standard deviation as presented in Table II. The mean scores for the statements range from 4.500 to 4.703, indicating a generally positive response. The median score for all statements is consistently 5.000, suggesting that at least half of the respondents selected the highest possible rating for each statement. While the mean and median clearly indicate the central tendency, it is also important to understand the variability in the responses. This can be measured using the standard deviation. The standard deviation values for the statements range from 0.489 to 0.987, indicating varying levels of consistency in the responses. For the statement 'Easy to use,' the standard deviation is 0.489, suggesting a high level of agreement and consistency among the respondents. The statement 'Provides error handling' has the highest standard deviation of 0.987, indicating more variability in responses, which suggests differing opinions among the respondents. Other statements, such as 'User-friendly' and 'Product recommendation accuracy,' have standard deviations of 0.615 and 0.645, respectively, showing moderate variability in responses. Most statements show relatively low standard deviations, with 'Easy to use' being the most consistently rated positively. The higher standard deviation for 'Provides error handling' suggests that there might be room for improvement in this area, as respondents had more varied experiences.

In summary, the mean and median scores indicate strong positive feedback overall, with most respondents rating the statements highly. However, the standard deviation values reveal that while most aspects are consistently well-received, some areas like 'Provides error handling' exhibit more variability in responses, highlighting potential areas for further investigation and improvement.

B. Correlation Analysis

In this study, we analyze the interrelationships among the variables of the nine questions being rated by the respondents to ascertain whether any variables exhibit correlation with each other. The correlation coefficient formula helps calculate the correlation coefficient which measures the dependency of one variable on the other variable. The correlation coefficient formula, denoted by r is a statistical measure used to quantify the strength and direction of the relationship between two variables. It is calculated by dividing the covariance of the two variables by the product of their standard deviations.

The formula is:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where, x_i and y_i represent individual data points, while denotes the means of the respective variables. Table III displays the correlation analysis results for the nine variables rated by 74 respondents using a 5-point Likert scale.

TABLE III. The Correlation Analysis and Results

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Easy to use (a)	1.000								
User-friendly (b)	0.837	1.000							
Product recommendation accuracy (c)	0.603	0.610	1.000						
Helpful to address queries (d)	0.738	0.659	0.583	1.000					
Helpful to share reviews and experiences (e)	0.554	0.605	0.401	0.625	1.000				
Skin type identification accuracy (f)	0.693	0.672	0.624	0.680	0.611	1.000			
Analysis features to identify cancerous skin (g)	0.686	0.745	0.661	0.720	0.572	0.780	1.000		
Provides error handling (h)	0.198	0.167	0.120	0.216	0.254	0.161	0.175	1.000	
User experience satisfaction (i)	0.377	0.425	0.700	0.340	0.351	0.389	0.445	0.196	1.000

Referring to the results, strong correlations are observed between the variables 'Easy to use' and 'User-Friendly,' as well as 'Easy to use' and 'Helpful to address queries' with coefficients of 0.837 and 0.738, respectively. The results show the importance of user-centric design in addressing user needs and enhancing usability.

Meanwhile, the variable ‘User-friendly’ exhibits a strong coefficient of 0.745 with ‘Analysis features to identify cancerous skin’, indicating that respondents perceive the feature for detecting cancerous skin as highly user-friendly. Moreover, ‘Analysis features to identify cancerous skin’ also has a high coefficient with 'Helpful to address queries' and ‘Skin type identification accuracy’ with 0.720 and 0.780 coefficients.

Therefore, the correlation analysis shows that the functionality's success in identifying cancerous skin is closely influenced by Android user-friendliness, the ability to provide helpful queries, and the accuracy of the skin type identification. There is a significant correlation with a 0.700 coefficient between the 'User experience satisfaction' and 'Product recommendation accuracy' variables, suggesting that user satisfaction is greatly impacted by Android's capability to offer precise product recommendations tailored to their skin conditions.

Future Research Direction

This study provides an initial empirical foundation for understanding the influence of human-centric design on user satisfaction and acceptance in a Malaysian skincare mobile application. Building on these findings, future research may extend the investigation by involving broader and more diverse user groups to further examine the applicability of the proposed design elements across different user profiles and usage contexts.

Future studies may also adopt complementary evaluation approaches alongside survey-based measures, such as usability testing, interaction analysis, or qualitative methods, to gain deeper insights into user behavior and system interaction. These approaches could provide a more comprehensive understanding of how human-centric features influence user experience in practice.

In addition, future research may explore extended usage scenarios to examine sustained engagement, long-term acceptance, and real-world usage dynamics over time. Such investigations would offer valuable insights into the durability and continued effectiveness of human-centric design in mobile skincare applications.

The skin cancer analysis feature introduced in this study also presents opportunities for further investigation. Future work may focus on enhancing this component through detailed technical validation, dataset evaluation, and ethical considerations, potentially supported by interdisciplinary collaboration with healthcare professionals to ensure accuracy and responsible use.

Finally, future research may consider comparative evaluations with existing skincare applications to better position the proposed solution within the broader digital skincare ecosystem. Further exploration of system scalability, data governance, and AI-driven personalization strategies may also enhance the application's readiness for wider adoption and practical deployment.

CONCLUSION

Referring to the initial study, it is clear that the consumers' acceptability and satisfaction of an Android application are significantly influenced by the meaningful design with the right functionalities. This is especially challenging due to the intricacies of the skincare sector, emphasizing the difficulties in Malaysian skincare companies developing captivating and user-friendly Android applications that satisfy a wide range of consumers' demands.

This paper explores the role of human-centric design to assist in the development of a skincare Android application. Human-centric design is a problem-solving technique that puts real people at the center of the development process, enabling product creation and services that resonate and are tailored to the consumers' needs. Even more, it not only helps in meeting the consumers' needs but also engages them on a personal level to ultimately drive their acceptance and loyalty.

The empirical investigation conducted allowed the potential consumers to experience the skincare Android application named Skinterest and provide their feedback. The results showed that the application developed with the human-centric design has high acceptability and has the potential to cultivate loyal consumers to the skincare product it represents, provided the skincare product works for them. The efficacy of the Skinterest application is proven by positive feedback with an overall of 94.6% user experience satisfaction achieved.

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