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Designing a User-Centered Facial Health Application (Glowessence) with Usability Testing

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Abstract: The study is carried out for developing the UI (User Interface) and UX(UX) of Glowessence App that enables users to determine their skin type and choose suitable facial care treatment for them. UI/UX Design process involves the User-Centered Design (UCD) principle which is primarily based on customer comfort and finding user requirements. In this study, the method adopted is Design Thinking (5 steps) which started from Empath, Define, Ideate, Prototype and Test. A System Usability Scale (SUS) is used during the testing phase to test the app with 29 participants and an average of 87 was scored — which falls into the "Excellent" category. Research results show the significance that UI/UX design based on direct user feedback could improve the success rate at solving skin care problems, making people more comfortable. The biggest novelty of this study is in a user-centered design solution enhancing application accessibility for a wider audience.

Keywords: Facial Health; Glowessence; Design Thinking; System Usability Scale; User-Centered Design.

1. Introduction

In the recent technological history of the world, a digital revolution on an unprecedented scale has disrupted the current state of health and personal care services from an individual perspective. Smart phones and applications are powerful catalysts in transforming the service delivery vector towards a personalized health/beauty solution that does away with traditional boundaries [1]. Digital Technology, Well Being and Personal Health is a transformation of the way that people are starting to approach; the strategies of health and hygiene management [2]. In recent years the healthcare technology industry has largely adopted innovative digital methods to improve service capabilities [3]. These technological interventions do not mirror technological enhancement, but rather present a full-fledged reimagining of how healthcare delivery ought to be. Mobile applications that are spot on in Skintelligence and personal healthcare represent the holy grail confluence of technologic development, user-centered design & innovative healthcare solutions [4].

The reason being that evolving needs of personal skin care and health management is the key motivation for developing specialized skincare application. Early-adopter contemporary consumers require personal-focused, available and technologically superior solutions that satisfy distinct skin health user needs [5]. With a plethora of skincare products, compounded by individuality of skin types this requires more complex recommendation systems that can offer slightly tailored advice [6]. Primarily, traditional skin assessments have been conducted on a one-to-one basis in clinics where it is costly and time-consuming and also highly geographically bound with limited reach [7]. Digital platforms represent a new model that offers transformative solutions to address these challenges based on advanced technologies like machine learning, Artificial Intelligence and user-centered design methodologies [8]. Skincare knowledge is a precious commodity, and therefore these technological interventions liberate the distribution and individualised recommendations.

Recent market research continues to validate the place of skincare within the broader beauty-and-personal care (BPC) ecosystem. Using surveys over the last decade and a half, a 2009–2017 in-depth report suggested the beauty product usage data points where skincare is a huge segment 36.1% and out-sells category haircare (22.9%) followed by makeup 17.3%. There is no denying the data overpoints the importance of special skincare solutions, tailored to users' needs and delivered through a modern skincare solution [9][10]. Fulfilling mobile applications in the domain of skincare require a suite of collaborative innovation, information technology and advanced skin health requirements [11]. User Interface /User Experience[UI/UX] design as a key player in the creation of intuitive, engaging and good digital platforms [12]. This is the not-so-distant future and my end game is to use those experiences people wind up building for themselves in carving out their own curated skincare routines [13]. There has been a variety of methodological studies undertaken in literature regarding creating stronger recommendation systems for skincare prior to the present research. Neural collaborative filtering methods have shown good performance to be used for generating individualized recommendation systems [14]. Scholars have also attempted different strategies like Analytical Hierarchy Process (AHP) and more sophisticated customer relationship management systems in order to propose fine tuned product recommendation systems [15]. In this paper, we highlight the social and psychological dimensions of skincare technology as an essential but seldomly considered layer of digital health solutions. The comprehensive research uncovered truly tremendous impact of digital platforms on consumer behavior, perceptions of beauty and self-care [16]. Complete mobile applications offering complete skincare solutions have transformative power to turn the way we think, perceive and treat our skin [17].

Usability and User satisfaction are important aspects to measure the effectiveness of digital health apps. Some well established methodologies like heurisitic evalutation and System Usability Scale (SUS) provide strong, empirically tested frameworks that can be used to assess user-friendliness in digital interface evaluating [18]. These evaluation approaches give confidence that a clinical application not just meets but satisfies and offers an immersive, user-friendly interaction [19]. Design Thinking has become a game changing, empathetic approach to design digital solutions from start to finish. Through the lens of empathy, iterative design processes and continuous user input, this methodology allows you to build applications that are meaningful and solve genuine challenges for users. Within the realm of skincare technology, Design Thinking provides developers with the tools to create more relevant, personalised and relevant digital platforms.

The constant evolution towards digital transformation within skincare technology transcends being only as a technological development and represents a major redefinition in the management of personal health and wellness. Drawing on advanced technologies, user-oriented design approach and knowledge of existing skin health variations, these clever solutions will change the way people think about skincare. Beyond the zeitgeist of technological advancement, one can imagine an array of more complex, personalized and accessible solutions for skincare. Future technologies soaking artificial intelligence, machine learning and user experience design will yield to a point where skincare recommendations become not only personalized but predictive, adaptive and merged across health plans.

2. Related Work

Recent years have seen substantive technological innovations throughout the skincare technology field, with scientists investigating potential for more unique strategies by which to approach personalized skin health management. Manurung and Baizal (2024) created the neural collaborative filtering techniques for personalized recommendations of skincare and shown that, the machine consumed algorithm able to perceive different skin care wants for every individual [1]. User experience design can be the differentiating element for skincare applications. Wulandari et al. (2023) highlighted the shift of designing human-centered principles for more intuitive mobile interfaces for skin analysis and product recommendations [2]. Their work demonstrated that deliberate user interfaces can elevate engagement and user satisfaction even in digital skincare applications.

Critical Element of Skincare technologies: Recommendation systems have been critical with current in skincare technology. Prasetiyo & Hidayat (2024) a Cut Detection System for Face Skin Type that Combines Machine Learning & Advanced Skin Analysis Technique [3]. This solution illustrates the opportunity that technology presents for personalized and accurate assessment tools to skin. A key research focus in the fashion of AI nutrition- what is more useful than pretty skincare technology. Azizah et al. (2023) examined AI-driven recommendation systems that considered skin, environmental as well as individual skin and personal conditions [4]. Their work showed the complexity to have holistic skincare recommendation platforms.

Significant transformations by social media and digital platforms in the development of skincare technology. Rasyid & Kurniawan (2024) studied the relationship between digital platforms and consumer behavior in the context of choosing a skincare product producing the intricate links with tech and creations [5]. They illustrated the value to know end-user preferences and behavioral trends. Machine learning has shown an efficient potential to build complex skincare recommendation systems. Zaydan and Sancoko (2023) used complex collaborative filtering approaches to user rating and product annotations [6]. They demonstrated a more fine-grained approach; in terms of recommendation generation for individual skincare.

Usability assessment is still a major part of digital health applications. Sriyeni and Pratama (2024) Systematic reviews using heuristic analysis, and System Usability Scale (SUS) to evaluate the utility of mobile skincare applications [7]. Their research derived the need of continual advancement viewpoints on UI for user experience. Intersecting of data science and skin technology paved routes for new personalized health solutions. Nurul et al. Developed a intricate machine learning-based model to aggregate user data [8], facial recognition and cosmetic recommendations [9]. The proposed methodology significant demonstrated that data driven practices could meet individualized skincare requirements. Design thinking methodologies have been quite helpful for designing user-first skincare technologies. Karo and Sekali (2024) Construct more user friendly, digital platforms for skin health management by using iterative design processes [9]. One of their research points to the need of empathy and real time user feedback in technological development. Recent research has also been directed to the psychological aspects of how some consumers perceive skincare technology. Wardani and Prasetyo (2023) investigated the effect of personalized skincare recommendations on user self-confidence through the digital platform in skin care self-identity [10]. The article really drove home the all-encompassing need to create digital health solutions. Altogether, these studies depict the multi-disciplinary state of skincare technology research and how machine learning and user-experience design can be fused with healthcare technology in creating digital solutions for consumer centered personal care management.

3. Research Method

This study uses the Design Thinking method as the main approach to designing an Android-based facial skincare application solution. Design Thinking was chosen because its approach is very focused on a deep understanding of users and solutions that can be well received by them. Unlike other methods, such as the Waterfall method which is more rigid and linear, or Agile which is more oriented towards software development, Design Thinking offers flexibility and iteration that allows the team to be more responsive to user needs and input. This approach is very relevant in the context of UI/UX design, where user experience is the main priority. The following are the stages in design thinking.

1) Empathize
   The first stage in Design Thinking focuses on collecting data on problems faced by users. At this stage, interviews were conducted with two sources who have expertise in the field of skin care to explore the challenges often faced by users. In addition, observations were also conducted on 10 people who represent potential application users to gain a broader perspective on their needs. This process is very important so that the solutions developed can be in accordance with user expectations and provide more value in solving their problems.

2) Define
After data is collected in the Empathize stage, the next stage continues by grouping the interview results and user feedback to identify the main problems that need to be solved. This process includes analysis to understand user needs and map the features needed by the application. The formulation of the core problem is that it can be solved by the application, such as how to identify skin types correctly and provide relevant treatment recommendations. A clear understanding at this stage is important to define the focus of the design and further development of the application.
3) Ideate
This stage collects ideas generated based on interviews and the results of problem analysis from the previous stage. In the brainstorming session, various potential solutions were produced to answer the challenges found. These ideas are then selected and formulated into more structured design concepts, which will be realized in the form of prototypes. The Ideate process provides a space for teams to be creative and explore various alternative solutions that can improve the user experience.
4) Prototype
After the ideas are selected, the next stage is to develop a prototype that describes the design of the application interface in a more concrete way. This prototype serves to illustrate the interface of the application to be tested. Work on several prototype versions was carried out with various design elements and features selected in the previous stage. This prototype is then used in testing to see if the design meets user expectations and can address the issues identified in the Define stage.
5) Testing
In the final stage, the prototype that has been developed is tested by users to evaluate the extent to which the interface design can meet their needs. Testing is conducted using the System Usability Scale (SUS), which is one of the most popular usability testing tools and has proven to be effective in measuring the comfort and ease of use of an application. SUS consists of 10 questions that measure the user's experience in using the application. The resulting score can provide a clear picture of what aspects need to be improved or improved in the application.

The data collection process was carried out using in-depth interviews and observations of 10 prospective users who had been selected by purposive sampling. The sample was selected based on age criteria, experience using health or beauty applications, and suitability with the purpose of the study, namely users who need facial skin care solutions. The subjects used by 10 respondents were used to maintain the focus and quality of the data collection results, as well as to gain deeper insights into user preferences.

Table 1. Questionnaire Questions

No	Question
1	I'm thinking of using this system again
2	I find this system complicated to use
3	I find this system easy to use
4	I need help from other people or technicians in using this system
5	I feel that the features of this system are working properly
6	I feel that there are a lot of inconsistencies (incompatible with this system)
7	I feel like others will understand how to use this system quickly
8	I find this system confusing
9	I feel that there are no obstacles in using this system
10	I need to familiarize myself first before using this system

For usability testing, the System Usability Scale (SUS) is used. Each question in SUS has 5 answer options, each of which is assigned a score ranging from 1 (strongly disagree) to 5 (strongly agree). The score results are then calculated in the manner described in the previous section, which will result in an average score for each respondent. This average SUS score gives an indication of how well the app is developed in terms of usability, where a score above 80 is considered excellent and indicates an easy-to-use interface.

Table 2. Questionnaire Answers

Answer	Score
Strongly disagree (STS)	1
Disagree (TS)	2
Neutral (N)	3
Agree(s)	4
Strongly Agree (SS)	5

$$\bar{x} = \frac{\sum x}{n}$$

Information:
$\bar{x}$ = Average score
$\sum x$ = Total SUS score
n = Number of respondents

The Design Thinking method was chosen because this approach prioritizes the direct involvement of users in every stage, from problem identification to solution testing. Design Thinking allows for more flexible iteration and development of solutions. This method also ensures that the end result of the application will truly meet the needs and expectations of the user, as every decision in the design is based on direct input from them. Thus, Design Thinking is believed to be the right approach to designing facial skincare applications that can provide the best experience for users. The Design Thinking method provides a systematic and iterative approach in designing solutions that suit user needs. By prioritizing empathy for the user, clearly defining the problem, and testing the prototype directly, this method ensures that the developed application will be effective and easy to use. Through the testing process with the System Usability Scale (SUS), the quality of the application interface can be known and make the necessary improvements to improve the user experience.

4. Result and Discussion

4.1 Results

4.1.1 Empethize

In the early stages of the Design Thinking method, the process begins with conducting interviews to explore the problems and needs of prospective users of the Glowessence application. This stage is crucial because it can provide deep insights into what users are experiencing regarding facial skin issues and how they hope the app can help them. Interviews were conducted with two participants who had similar facial skin problems. In this interview, we focus on questions that can dig into the core of their problems and expectations regarding the application of Glowessence. Here is a list of questions asked during the interview.

Table 3. Interview Questions

No	Questions
Q1	What facial problems are you currently experiencing?
Q2	How long do you have problems with your facial skin?
Q3	What do you expect about the design of this glowessence application?
Q4	What features do you want if this glowessence application has been realized?
Q5	What do you dislike about an app?
Q6	What makes you agree with this application?

From the interview, very valuable information was obtained to determine the direction of application development. For example, most respondents revealed that they face skin problems such as acne, acne scars, and dull skin. In addition, they wanted an easily accessible solution for facial care and products that could be purchased directly through the app. In addition, some participants also expressed hope that this application can provide advice from experts and consultation with dermatologists. Based on this interview, it succeeded in identifying several main needs that must be met by the Glowessence application, including easy access to information and services, the existence of features that provide education about facial care, and marketplace features to make it easier to purchase skincare products.

4.1.2 Define

After obtaining the results of the interview, the next step continues to the Define stage, which is to compile and classify user needs based on the findings from the Empathize stage. In this stage, the features that will be embedded in the Glowessence application are also determined based on the results of interviews and further analysis. At this stage, three categories of user need that must be met in this application are identified, namely functional, non-functional, and feature needs. Functional needs are needs that are directly related to the main function of the application. Non-functional needs are related to user comfort in using applications, such as appearance and ease of use. Feature needs are Features that users want, which include the ability of the app to provide doctor consultation services, a marketplace to buy skincare products, and articles about facial health.

Table 4. Results of User Needs Excavation

No	Functional	Non-Functional	Feature
1	*Sign* in with *your Google* account or another account	Simple Display	*Login*
2	Can consult a doctor	Accessible usage	Doctor's consultation
3	Can buy *skincare products*	Easy to use	*Marketplace*
4	Can read facial health articles	Content is clearly readable	*News*

From the results of this excavation, a clear picture of the features and elements desired by users is found. Consultation with a dermatologist is highly appreciated by users who want to get professional advice regarding their skin concerns. In addition, the need to have a marketplace that allows them to buy skincare products directly from the app is also very urgent. Another feature that many want is a health article that can provide education about facial care and skin health.

4.1.3 Ideate

After the Define stage, the next step continues to the Ideate stage, which is the stage to generate ideas to overcome the problems found in the Empathize stage. At this stage, the ideas obtained from the interview are used as the basis for compiling the user flow. This flow describes how users will interact with the application, from logging in to accessing various features in the application. This user flow is very important because it can help in designing an efficient and easy-to-understand user experience. Here's an overview of the generated user flow, which includes the steps users must follow to use the Glowessence app smoothly.

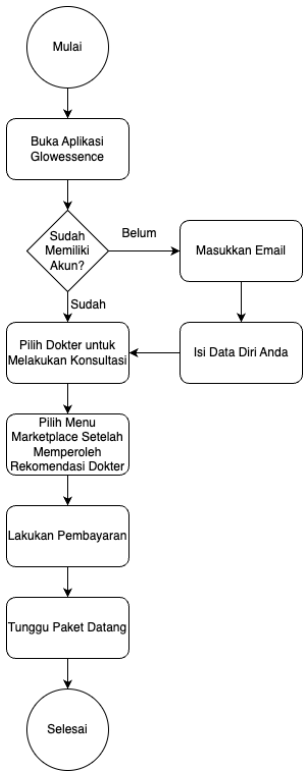

Figure 1. *User flow*

Once the user flow is composed, the next step proceeds to create the wireframe. A wireframe is a design framework that describes how the layout and structure of the content will be displayed on the app screen. This wireframe provides an initial overview of the application design without focusing on more detailed visual elements. Here's an example of a wireframe that illustrates the layout of an application.

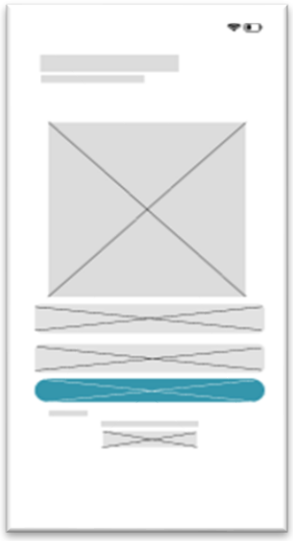

Figure 2. Product Wireframe

With this wireframe, it is easy to do visual guidance that can be used to design the application interface in more detail at the next stage.

4.1.4 Prototype

After the ideate stage is completed, it then proceeds to the Prototype stage. At this stage, the ideas and designs that have been created before are implemented in the form of application prototypes that users can test out. These prototypes serve to test the design and functionality of the application, as well as to identify potential problems or areas that need to be fixed. Some of the prototypes of the Glowessence application that were generated included the main page view, the doctor consultation page, and the marketplace page. Here are the images of the resulting prototype display.

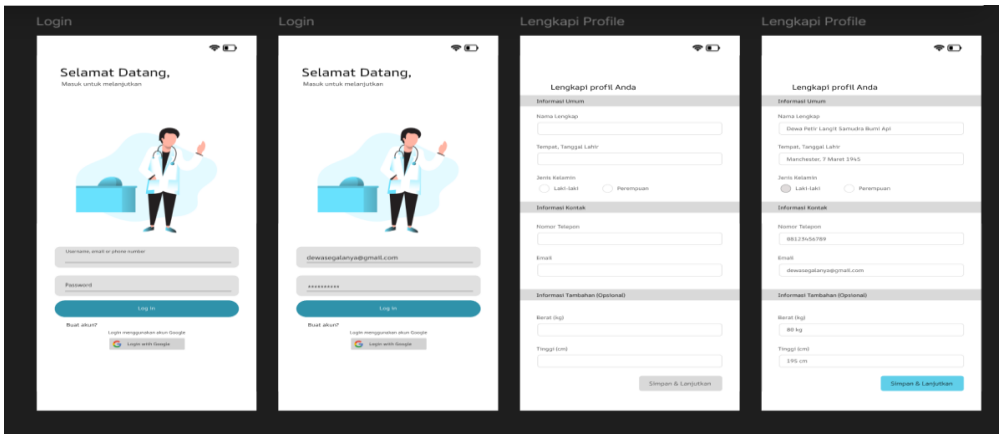

Figure 3. Login and Register Display

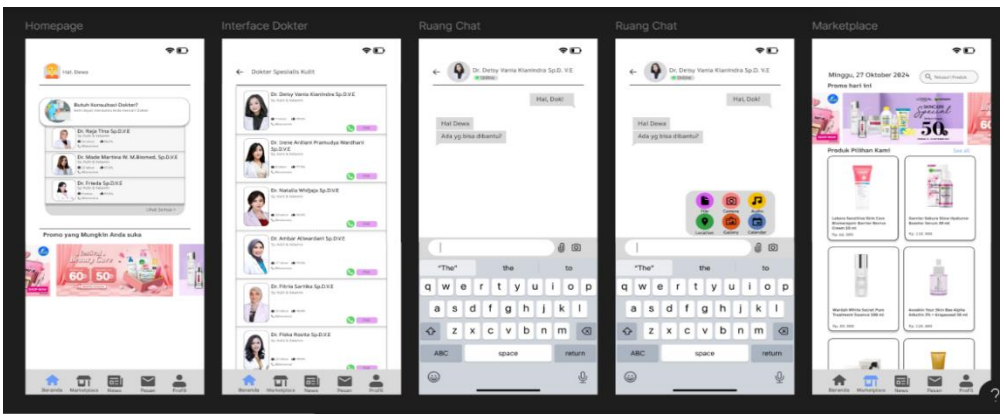

Figure 4. Home and Marketplace View

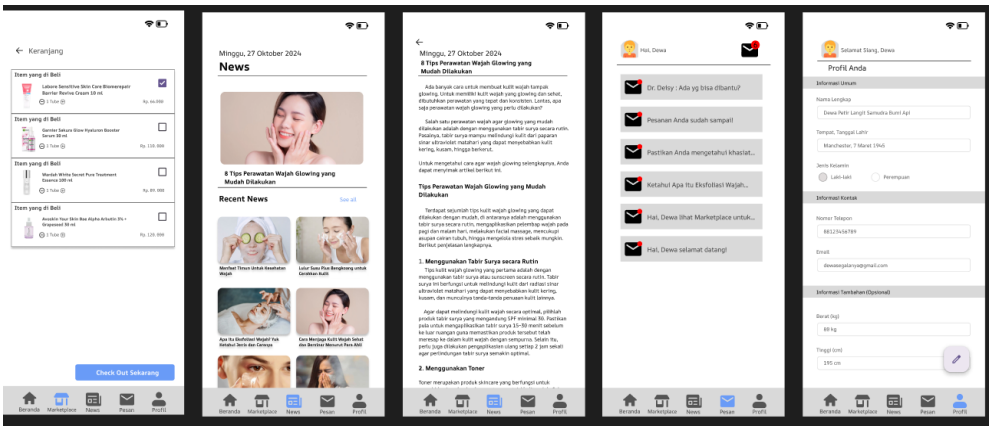

Figure 5. Content Display in the App

The appearance of this prototype depicts a simple and easy-to-use user interface, in accordance with the needs identified in the previous stage. This design is designed so that users can easily access various features in the application, from consulting a doctor, buying skincare products, to reading facial health articles.

4.1.5 Testing

Once the prototype is ready, proceed to the testing stage. At this stage, testing is carried out using the System Usability Scale (SUS) to assess how easy and effective the application is to use by users. The SUS score provides an overview of the level of user satisfaction with the application interface, which can be used to evaluate whether the application has met user expectations.

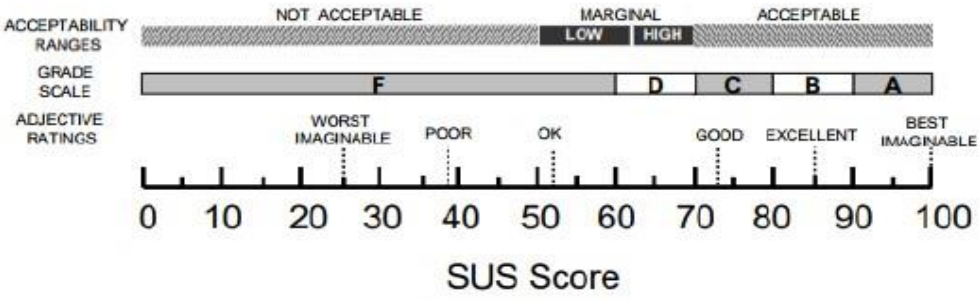

Figure 6. SUS Final Score

Table 5. Respondent Data

No	Respond	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Sum	Value (Sum x 2.5)
1	1 Answer	4	4	4	3	4	4	4	4	4	3	38	95
2	2 Answer	4	3	3	3	4	3	4	4	4	3	35	87,5
3	3 Answer	4	4	4	4	4	4	4	4	4	4	40	100
4	4 Answer	4	3	4	3	4	3	4	3	4	3	35	87,5
5	5 Answer	4	3	3	3	3	3	3	3	3	3	31	77,5
6	6 Answers	4	3	4	4	3	3	4	3	4	4	36	90
7	7 Answers	3	3	3	3	3	4	4	3	3	4	33	82,5
8	8 Answers	3	4	3	4	4	4	4	4	3	4	37	92,5
9	9 Answer	3	3	3	3	3	3	3	3	3	3	30	75
10	10 Answer	3	3	4	3	3	3	4	4	3	3	33	82,5

For the calculation of the amount of SUS from each respondent, the average score is found by summing all the scores and dividing by the number of respondents. The following is the formula for finding the number of SUS.

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{870}{10}$$

$$\bar{x} = 87$$

Through the average score obtained of 87, the Glowessence application can be categorized in the Excellent level based on the results of the SUS test. This score indicates that the app is well received by users and has an easy-to-use interface. Based on the findings of the research, some recommendations for the further development of the Glowessence application are.

1) Personalize User Experience
   Given the diversity of skin problems experienced by users, the development of more in-depth personalization features can be a very important step. For example, apps can use artificial intelligence (AI) technology to provide more specific product recommendations based on the user's skin condition, as well as provide more personalized treatment suggestions.
2) More Interactive Consultation Features
   Although the consultation with a dermatologist feature is already one of the features that users want, further development in terms of interactivity such as video calls or live chats with doctors can improve the user experience. This feature allows users to feel closer and get more precise solutions from experts.
3) Improved Accessibility
   To ensure that applications can be used by different layers of users, the development of more user-friendly applications, especially for users with limitations, needs to be considered. For example, adding screen reader features for users with visual impairments or displays with higher contrast.
4) Marketplace Feature Development
   The marketplace feature that makes it easier for users to buy skincare products from the app needs to be improved by adding a user review feature and a product rating system. With feedback from other users, new users can more easily choose products that suit their needs.
5) More In-Depth Education Features
   Educational articles and videos about facial skin health can be further developed. Providing different types of articles divided based on specific skin concerns, as well as skincare tips based on different skin conditions, will add value to users looking for more in-depth solutions. Nevertheless, even though these scores indicate positive results, the product still needs to be further evaluated to see which aspects of the app are responding better and which need improvement.

Although the SUS score indicates that the application is in the Excellent category, in-depth analysis of certain elements of the application is still needed. Some parts of the application may receive very positive responses, such as the doctor consultation feature and marketplace. However, there are also parts that may need to be improved, such as the interface or certain features that are less responsive on some devices. In addition, the results of interviews and testing can be used as a basis for further application development. For example, if users feel that the marketplace has not met their expectations, the application can be developed by adding new features such as more personalized product recommendations or a more in-depth product review system. All of this aims to improve the user experience and provide the best solution for their facial skin problems. By optimizing the results obtained from the testing and analysis stage, it is hoped that the Glowessence application can be improved and perfected to better suit the needs and expectations of users.

4.2 Discussion

With the development of the Glowessence application, the Design Thinking methodology — an experimental approach to designing digital solutions for skin care. This study is in line with the advancement of e-health technology that has shown that the beauty sector is actually very potential to serve personalized services [4][2]. The user's skin problems are not as simple as stated in the Empathize stage. Recent research findings show that most respondents suffer from acne, acne scars or uneven/rough skin types [5]. This is in line with the need for a complete digital solution, which is capable enough to provide recommendations on the right skin care products [7]. Manurung (2024) noted that Neuronal Collaborative Filtering can improve accuracy in personal skin care product recommendations [1]. This is illustrated by the principles of User Experience (UX) Design such as the Glowessence interface which is designed to meet the aesthetic needs of users. The minimal design we chose is intended to facilitate an intuitive user experience, as has been extensively researched by Karo Once et al. on the essential elements of good interface design [9]. Nurul Hikmah et al. (2022) even emphasized that user journey analysis in effective application design is very necessary. The focus of development is only the product recommendation feature [10]. Zaydan Azfar and Sancoko (2024) also explained that with a method like Promethee, one can get much better skincare product recommendations [11]. In addition, research presented in Qalbyassalam et al. (2022) that Neural Collaborative Filtering can be an effective system for skincare product recommendations under implicit ranking due to increased relevance [12]. Of concern is the high accessibility and personalization. Mentari and Anggaalih (2022) noted that interfaces that ignore material design guidelines are the most difficult to design [15]. Proposed a product suggestion system that implements favorite products and after recommendations to do treatment [16]. Sriyeni (2022) showed that through the Usability testing of the System Usability Scale (SUS),

the use of digital applications must be very positive with the use of the results [18]. In this case, the average score of 87 shows that Glowessence is able to meet user expectations for ease of use and functionality.

5. Conclusion and Recomendations

From the results of the discussion that has been presented, the development of user interface (UI) and user experience (UX) design on the Glowessence application has positive potential that will help users, especially people who have facial skin problems. This application will be useful for conveying valuable knowledge and solutions about facial skin care in a simple way through recommendations for skin care products to the public easily, effectively, and accurately. UI and UX are developed to ensure that all features in the application can overcome problems experienced by the public such as acne, acne scars, or dull skin. Applications with features that suit the needs and desires of users can be designed by implementing in-depth interviews to understand user needs, being able to provide ready-to-use information for users to overcome problems, having access to dermatologist consultation services, and buying skin care products/ayurvedic products rather than reading articles about skin. The results of the Glowessence System Usability Scale (SUS) test showed an average score of 87 which is included in the Excellent category (Figure 1) and this indicates that the application is more usable (higher SUS score) than reasonable (lower score). This score means that the application level runs smoothly and can be used and meets needs. However, despite the high user acceptance of this score, further testing is highly recommended to provide improvements or additions as well.

With this, it is predicted that the development of the Glowessence application will greatly affect the quality of life of its users. Quick and effective recipes to overcome facial skin problems Users will no longer waste time searching for solutions that separate materials in information. One example is the distribution of the platform and in one location get all the answers for skin care for education, specific products for your skin type information, or consultation with a dermatologist. This provides relief to users because they save time and effort, while increasing confidence that the solutions provided are professional advice. Online users can buy recommended products from an integrated marketplace in the application which will ultimately improve their quality of life by providing the best products needed for the care they need. The application also comes with several educational features that help teach users about the health of their skin surface, which can be a great tool in helping them make informed decisions about facial skin.

Although this study has some valuable findings, there are some limitations that must be considered. One of them is the small number of participants in the SUS trial. The results obtained may not fully reflect the users and experience through the SUS test because there were only 10 participants involved. Thus, additional research with a larger number of participants and different ages, genders, and skin types is needed to verify the extent to which this application is accepted across markets. Furthermore, I focused on the user interface design and UX of the application for this study, without considering external factors such as other external systems (e.g., the OS on which the application is running) or other technical issues that may arise after the application has been operated for a long time by users, etc. Further evaluation is needed to measure the overall performance quality of the application, both in terms of setting technical standards and long-term user experience.

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