



FINAL PROJECT – TI 184833

DEVELOPMENT OF SCORING SYSTEM USING CASE-BASED REASONING IN VIRTUAL BEAUTY ADVISOR APPLICATION

AISHA RANA SABHIRA
NRP. 02411640000204

Supervisor

Arief Rahman, S.T., M.Sc
NIP. 197706212002121002

Co-supervisor

Retno Widyaningrum, S.T., M.T., M.B.A., Ph.D
NPP. 1990201912074

DEPARTMENT OF INDUSTRIAL SYSTEM AND ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY AND SYSTEMS ENGINEERING
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA
2020



FINAL PROJECT – TI 184833

DEVELOPMENT OF SCORING SYSTEM USING CASE-BASED REASONING IN VIRTUAL BEAUTY ADVISOR APPLICATION

AISHA RANA SABHIRA

NRP 024 1164 0000204

Supervisor

Arief Rahman, S.T., M.Sc

NIP. 197706212002121002

Co-supervisor

Retno Widyaningrum, S.T., M.T., M.B.A., Ph.D

NPP. 1990201912074

Department of Industrial and Systems Engineering

Faculty of Industrial Technology and Systems Engineering

Institut Teknologi Sepuluh Nopember

Surabaya 2020

APPROVAL SHEET

DEVELOPMENT OF SCORING SYSTEM USING CASE-BASED REASONING IN VIRTUAL BEAUTY ADVISOR APPLICATION

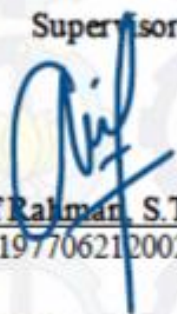
FINAL PROJECT

Submitted as one of the requisites to achieve a Bachelor Degree of
Industrial and Systems Engineering Department
Faculty of Industrial Technology and Systems Engineering
Institut Teknologi Sepuluh Nopember
Surabaya

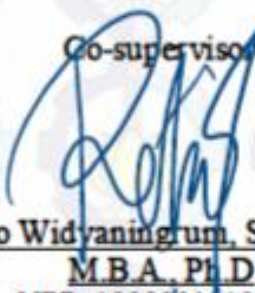
Written by:
Aisha Rana Sabhira
NRP 02411640000204

Acknowledged and approved by:

Supervisor


Arief Rahman, S.T., M.Sc
NIP. 197706212002121002

Co-supervisor


Retno Widyaningrum, S.T., M.T.,
M.B.A., Ph.D
NPP. 1990201912074



(This page is intentionally left blank)

DEVELOPMENT OF SCORING SYSTEM USING CASE-BASED REASONING IN VIRTUAL BEAUTY ADVISOR APPLICATION

Name : Aisha Rana Sabhira

NRP : 02411640000204

Supervisor : Arief Rahman, S.T., M.Sc

Co-supervisor : Retno Widyaningrum, S.T., M.T., M.B.A., Ph.D

ABSTRACT

Cosmetic industry is one of the industries with a promising opportunity in Indonesian market. One of the factors that caused this is the rise of online platform that enables consumers to access information related to beauty trends directly from the experts. But, the sales generated through online channels for cosmetic products are considerably low due to the lack of direct experiential information. Several brands such as L'Oreal Paris are adapting Virtual Try-On technology as a solution that enables consumers to experience novelty in online shopping. However, there is still a lack of intimacy in terms of knowledge sharing from experts to consumers due to the limitation of the augmented reality technology. This research aims to increase the consumers' experience by combining the Virtual Try-On's function with a scoring system based on the knowledge of beauty experts in the form of beauty advisor application. The scoring system was constructed using case-based reasoning method that utilizes the knowledge from beauty expert as the baseline for the 3 classification of score; high, normal, and low. The case-based reasoning system aims to give automatic score of the make-up look built by users based on user input to assure whether a product is suitable for them. The final result of this research is the drafted old cases as the general knowledge from the experts and the interface design as the visualization of the application. This research also provides the user scenario that shows the flow of Virtual Beauty Advisor usage.

Keyword: Case-based Reasoning, Knowledge Management, Usability, Virtual Try-On.

(This page is intentionally left blank)

PENGEMBANGAN SISTEM PENILAIAN MENGGUNAKAN *CASE-BASED REASONING* PADA FITUR *VIRTUAL BEAUTY*

ADVISOR

Nama : Aisha Rana Sabhira
NRP : 02411640000204
Pembimbing : Arief Rahman, S.T., M.Sc
Ko-pembimbing : Retno Widyaningrum, S.T., M.T., M.B.A., Ph.D

ABSTRAK

Industri kecantikan di Indonesia merupakan salah satu industri yang memiliki masa depan yang menjanjikan. Salah satu faktor yang mendasari hal ini adalah perkembangan *online platform* yang memudahkan konsumen untuk mendapatkan informasi mengenai tren kecantikan langsung dari *expert*. Akan tetapi, perolehan penjualan kosmetik melalui kanal *online* masih tergolong rendah karena konsumen tidak dapat mencoba produknya secara langsung. Beberapa perusahaan seperti L’Oreal Paris mengadaptasi teknologi *Virtual Try-On (VTO)* sebagai solusi yang memudahkan pengguna dalam berbelanja *online* karena pengguna dapat mencoba produknya secara virtual. Namun, masih ada kekurangan dalam hal penyebaran pengetahuan dari *expert* kepada pengguna yang juga disebabkan oleh keterbatasan teknologi *augmented reality*. Penelitian ini bertujuan memperkaya *user experience* dengan menggabungkan fitur *VTO* dengan sistem penilaian berdasarkan pengetahuan dari *beauty experts* dalam bentuk fitur *virtual beauty advisor*. Sistem penilaian tersebut dibangun menggunakan pendekatan *case-based reasoning* dengan 3 klasifikasi nilai; *high*, *normal*, dan *low*. Sistem ini digunakan untuk memberikan respon mengenai kesesuaian produk yang dipilih melalui *VTO* dengan input dari pengguna. Hasil dari penelitian ini berupa *case* yang disusun dari pengetahuan *expert* serta desain antarmuka fitur *Virtual Beauty Advisor*. Penelitian ini juga dilengkapi dengan *user scenario* yang menunjukkan alur penggunaan fitur *Virtual Beauty Advisor*.

Kata kunci: *Case-based Reasoning, Knowledge Management, Usability, Virtual Try-On.*

(This page is intentionally left blank)

PREFACE

Praise be upon God Almighty, Allah SWT, for His grace and blessings that made it possible for the author to complete this research. The author would also like to express the gratitude towards the supportive people and other parties mentioned as follow:

1. Mr. Arief Rahman, S.T., M.Sc as the supervisor and Mrs. Retno Widyaningrum, S.T., M.T., M.B.A., Ph.D as the co-supervisor of this research, for all the guidance and approval given to this research.
2. Mrs. Dewanti Anggrahini, S.T., M.T., Mrs. Anny Maryani, S.T., M.T., and Mrs. Dyah Santhi Dewi, S.T., M.Eng.Sc, Ph.D as the examiners of proposal seminar, for all the feedbacks that made this research improved in better way.
3. Mr. Nurhadi Siswanto, S.T., M.S.I.E., Ph.D., as the head of Industrial and System Engineering Department and all the lecturers who have given the knowledge and inspiration throughout four years of studying.
4. Nedita Farah, as the beauty expert, for the time and knowledge spared to the process of knowledge exploration through direct interview in this research.
5. All of supporting friends, especially 20 participants involved in the usability testing, for the valuable time and feedbacks given for the completion of this research.
6. Author's beloved parents, for the constant affection and wholehearted support in every aspect.
7. Author's beloved brother, for the constant affection and wholehearted support in every aspect.
8. All parties who had directly or indirectly involved in this research that cannot be mentioned one by one, for all the help, support, time, and valuable feedbacks.

Besides the gratitude, the author also acknowledges that this research still has many rooms to be improved. Therefore, the author wishes a sincere apologize if there was any mistake in this research. Critiques and recommendations are open to be

discussed. The author hopes that this research could be beneficial and insightful for the related industries. The author also expects that the findings from this research could inspire the upcoming research to be improved and applied in better way.

Surabaya, 30th July 2020

Aisha Rana Sabhira

TABLE OF CONTENTS

ABSTRACT	iii
ABSTRAK	v
PREFACE	vii
TABLE OF CONTENTS	ix
LIST OF TABLES	xiii
LIST OF FIGURES	xv
CHAPTER 1 INTRODUCTION.....	1
1.1 Background.....	1
1.2 Problem Formulation.....	6
1.3 Research Objectives	7
1.4 Research Benefits	7
1.5 Research Scope.....	7
1.5.1 Limitation.....	7
1.5.2 Assumption	8
1.6 Writing Structure	8
CHAPTER 2 LITERATURE REVIEW.....	11
2.1 Human Information Processing.....	11
2.2 Usability	12
2.2.1 Usability Testing	13
2.2.2 Post Study Usability Questionnaire	13
2.2.3 Think Aloud	16
2.3 Augmented Reality	16
2.4 Knowledge Management.....	17
2.5 Case-Based Reasoning	19
2.6 L’Oreal Paris Website	21
2.7 Previous Research	22
CHAPTER 3.....	25
3.1 Research Flowchart	25
3.2 Preliminary Stage	26
3.2.1 Literature Study.....	26
3.2.2 Field Study	27

3.3	Knowledge Exploration and System Development Stage	27
3.3.1	Knowledge Exploration.....	27
3.3.2	Case-based Reasoning	37
3.3.3	System Development.....	38
3.4	Analysis and Interpretation Stage	40
3.5	Conclusion and Suggestion Stage	40
CHAPTER 4	.....	41
4.1	General Overview of L’Oreal Paris Virtual Try-On Feature.....	41
4.2	Knowledge Exploration	42
4.2.1	Identification of Knowledge Needs.....	43
4.2.2	Knowledge Capturing.....	43
4.2.3	Case Drafting for Standardization of Scoring System.....	49
4.3	Case-based Reasoning	51
4.4	Usability Testing of Current Try On Feature.....	61
4.4.1	Participants Profile	62
4.4.2	Task and Scenario.....	62
4.4.3	Standardized Usability Questionnaire	63
4.4.4	Think Aloud.....	66
4.4.5	Open Questionnaire	67
4.5	Designing Virtual Beauty Advisor.....	70
4.5.1	User Interface Design	70
4.5.2	User Scenario.....	83
CHAPTER 5	.....	89
5.1	Analysis of Knowledge Management Model	89
5.2	Analysis of Usability Testing Result	90
5.3	Analysis of Virtual Beauty Advisor Design	91
CHAPTER 6	.....	95
6.1	Conclusion	95
6.2	Suggestion.....	96
REFERENCES	.....	97
ATTACHMENT	.....	101
	Attachment 1: Knowledge Capturing Questionnaire.....	101
	Attachment 2: Drafted Old Cases for Case-based Reasoning	105

Attachment 3: Post Study System Usability Questionnaire Result	131
AUTHOR BIOGRAPHY	135

(This page is intentionally left blank)

LIST OF TABLES

Table 2.1 PSSUQ Norms	15
Table 2.2 Research Roadmap.....	23
Table 3.1 List of Beauty Influencers.....	30
Table 3.2 Types of Knowledge	33
Table 3.3 Classification of User Input	34
Table 3.4 Example of Knowledge Conversion	36
Table 4.2 Example of Knowledge Capturing from Beauty Influencers.....	43
Table 4.3 Curated Product Descriptions	46
Table 4.4 The Example of Knowledge Translation	48
Table 4.5 Example of Old Case for High Score in Bold Make-up Style	49
Table 4.6 Example of New Case.....	52
Table 4.7 Example of New Case and Case 31 – High Score Similarity Test	54
Table 4.8 Example of New Case and Case 31 – Normal Score Similarity Test...	57
Table 4.9 Example of New Case and Case 31 – Low Score Similarity Test.....	59
Table 4.10 Recapitulation of Similarity level for New Case	61
Table 4.11 Tabulation of PSSUQ Result	64
Table 4.12 Think Aloud Recapitulation.....	66
Table 4.13 Steps of Virtual Beauty Advisor	84

(This page is intentionally left blank)

LIST OF FIGURES

Figure 1.1 Revenue in Indonesia's Cosmetic Segment	1
Figure 1.2 Percentage of Media Used to Search for Beauty Products Reviews	2
Figure 1.3 Percentage of Beauty Information Source from Indonesian Women	3
Figure 1.4 The Example of Beauty Influencer in Social Media	4
Figure 1.5 Sales Channels Percentage of Beauty and Personal Care in Indonesia	5
Figure 1.6 Virtual Try-On Feature in L'Oreal Paris Website.....	6
Figure 2.1 Generic Model of Human Information Processing.....	12
Figure 2.2 The Nonaka-Takeuchi SECI Knowledge Management Model	18
Figure 2.3 The CBR Cycle.....	20
Figure 2.4 L'Oreal Virtual Try-On	22
Figure 3.1 Research Flowchart	25
Figure 3.2 Research Flowchart (continued).....	26
Figure 3.3 Selected Make-up Artist	33
Figure 3.4 CBR Cycle of Proposed System.....	37
Figure 4.1 Interface of Virtual Try-On Feature	41
Figure 4.2 Comparison of User's Face With and Without Make-up	42
Figure 4.3 The Example of Question in Expert Questionnaire.....	45
Figure 4.4 The Example of Participant Trying Foundation Feature	63
Figure 4.8 Answer Result from Question no. 4	69
Figure 4.9 Landing Page of Virtual Beauty Advisor	71
Figure 4.10 Make-up Style Selection.....	71
Figure 4.11 Skin Condition Selection	72
Figure 4.12 Skin Tone Selection.....	72
Figure 4.13 User Consent.....	73
Figure 4.14 Example of Foundation Feature Usage	74
Figure 4.15 Example of Foundation Feature Usage (2).....	74
Figure 4.16 Example of Eyeshadow Feature Usage	75
Figure 4.17 Example of Eyeshadow Feature Usage (2).....	75
Figure 4.18 The Final Score - Low	76

Figure 4.19 The Final Score - Normal.....	77
Figure 4.20 The Final Score - High.....	78
Figure 4.21 The Example of Question in Second Questionnaire	79
Figure 4.22 The Result of Make-Up Selection Feature Ranking	79
Figure 4.23 The Result of Skin Condition Selection Ranking	80
Figure 4.24 The Result of Skin Tone Selection Ranking	80
Figure 4.25 The Result of Score Look Button Ranking	81
Figure 4.26 The Result of Score Generating Result Ranking	81
Figure 5.1 The Comparison of PSSUQ Norms and L'Oreal Virtual Try-On.....	90

CHAPTER 1

INTRODUCTION

This chapter presents the introduction that consists of background, problem formulation, research objectives, research benefits, and the research scope.

1.1 Background

The cosmetic industry is one of the industries that are thriving and gaining lots of consumers in recent years since cosmetic and personal care have become an integral part of women's daily lifestyles. Based on the report launched by the Indonesian-French Chamber of Commerce and Industry (IFCCI), Indonesia is predicted to be the top five Asian markets for cosmetics in the next 10 to 15 years with the revenue amounts to 497.7 million in 2019 (EU-Indonesia Business Network, 2019). The market is expected to grow annually by 2.6% from CAGR 2019 to 2023 and the revenue growth will continue to be positive as depicted in Figure 1.1. This implies that this industry has a wide opportunity in Indonesia.



Figure 1.1 Revenue in Indonesia's Cosmetic Segment

Source: (EU-Indonesia Business Network, 2019)

However, cosmetic market in Indonesia is still considered a highly competitive market where strong promotion is required in order to make a substantial entry into the market. Recent trend shows that newly established cosmetic brands that marketed through digital platforms are unsettling established major brands to begin selling and airing through digital platforms in order to stay competitive (EU-Indonesia Business Network, 2019). Social media is one of the powerful marketing tools to reach out to consumers and to be the key ingredient for the success of cosmetic brands (Chopra, 2018). The research conducted by ZAP in ZAP Beauty Index 2018 also stated that 73.2% of Indonesian women tend to search for the online review of the products before buying. Instagram becomes the most used platform for them to find the product reviews with a proportion of 55%. The second most used platform to find product reviews is YouTube, with the proportion of 41.6%. The other media used are from bloggers, friends, and brand representatives such as beauty advisors, websites, etc. The graph can be seen in Figure 1.2.

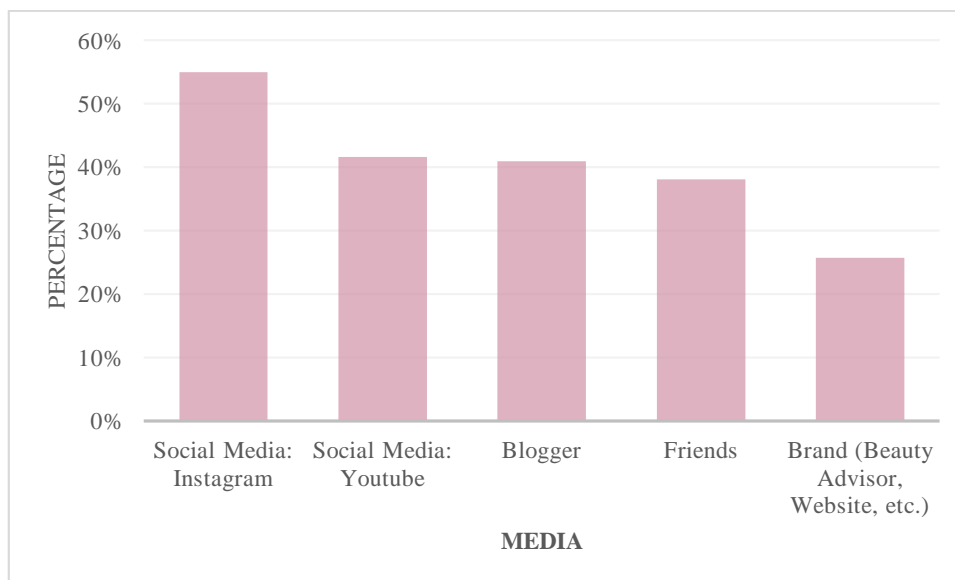


Figure 1.2 Percentage of Media Used to Search for Beauty Products Reviews

Source: (ZAP, 2018)

Followed with ZAP Beauty Index 2020, 42.2% of Indonesian women rely on the local beauty influencer as their role model in terms of beauty. 29.1% of them

stated that they got the influence from their mother. 23.6% of them got the influence of beauty products from international celebrities and the rest from local celebrities. The graph is shown in Figure 1.3. This means that before deciding to buy the product in an offline store, consumers prefer to look for online reviews of the products.

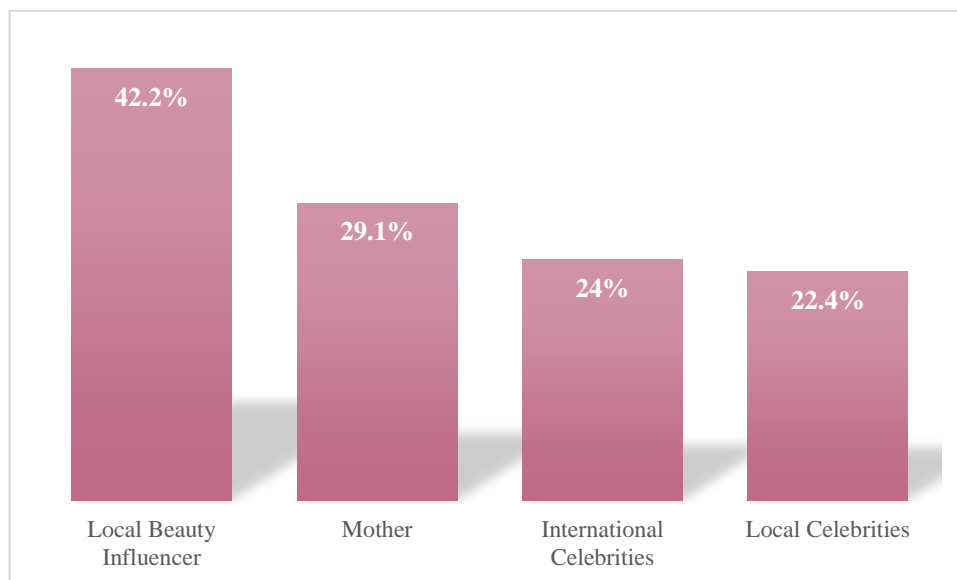


Figure 1.3 Percentage of Beauty Information Source from Indonesian Women

Source: (ZAP, 2020)

Figure 1.4 shows the example of beauty influencer in social media. This expert can attract the mass by making cosmetic reviews and tutorial videos. She tends to give tips on make-up techniques. The viewers watch the videos to follow her techniques on doing make-up and see the product recommendations from her as they perceive this figure as the expert of cosmetics. However, there is still a lack of intimacy between the viewers and the expert caused by one-way communication provided by the internet albeit the fact that most of the viewers rely on the beauty influencers for make-up techniques and product recommendations.

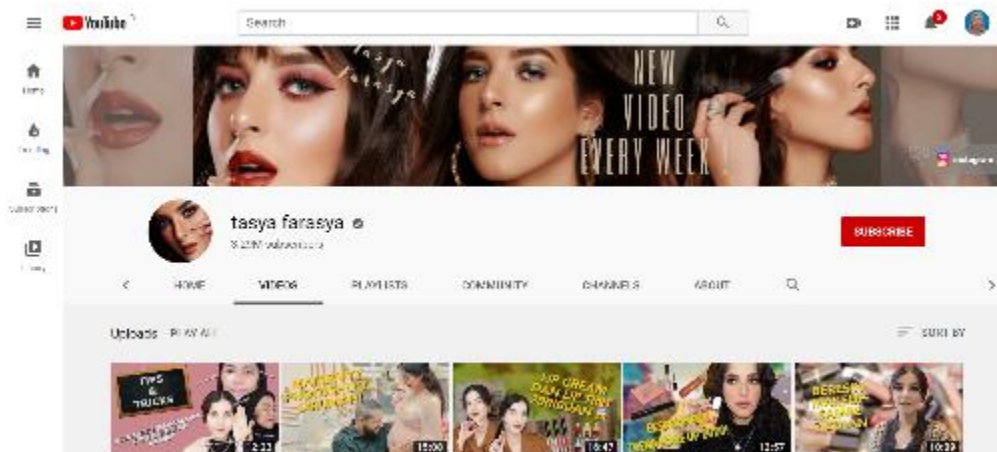


Figure 1.4 The Example of Beauty Influencer in Social Media

Source: Youtube Channel of Tasya Farasya

However, digital platform is more reliable for consumers to find information about the products than to make purchasing. The sales generated through offline distribution channels in cosmetics are still high. As what had been captured in Figure 1.5, the sales through online channels in Indonesia are considerably low compared to the conventional offline channel that will still lead with 83% of the sales in 2023. Nonetheless, the number is still estimated to keep growing. Figure 1.5 shows the graph of the sales channel percentage in Indonesian beauty and personal care industry from 2016 to 2023. By this data, it gives a chance for online stores to elevate the quality and user experience to fill the gap between direct shopping experience and online shopping experience. One of the things that differentiate online shopping from offline shopping is the convenience of not having to leave the house to get the product because online shopping convenience has become increasingly significant in explaining the motivation of online shopper (Meixian, 2015). Moreover, online shopping sites such as e-commerce may also offer lower prices than offline store. Despite the convenience brought by online shopping, the drawback that can be felt is the inability to test or wear the product directly. Many people still need to go to the offline store to research how the product works on them, then continue buying through online store (Gupta et al., 2013). This can be inferred that, amid the fact that the users already obtain the information through the product description and online review from beauty experts, they still

cannot experience and see how the product fits to them. Lack of direct experiential information makes it difficult for users to determine whether the product fits and leads to less customer enjoyment (Merle et al., 2012).

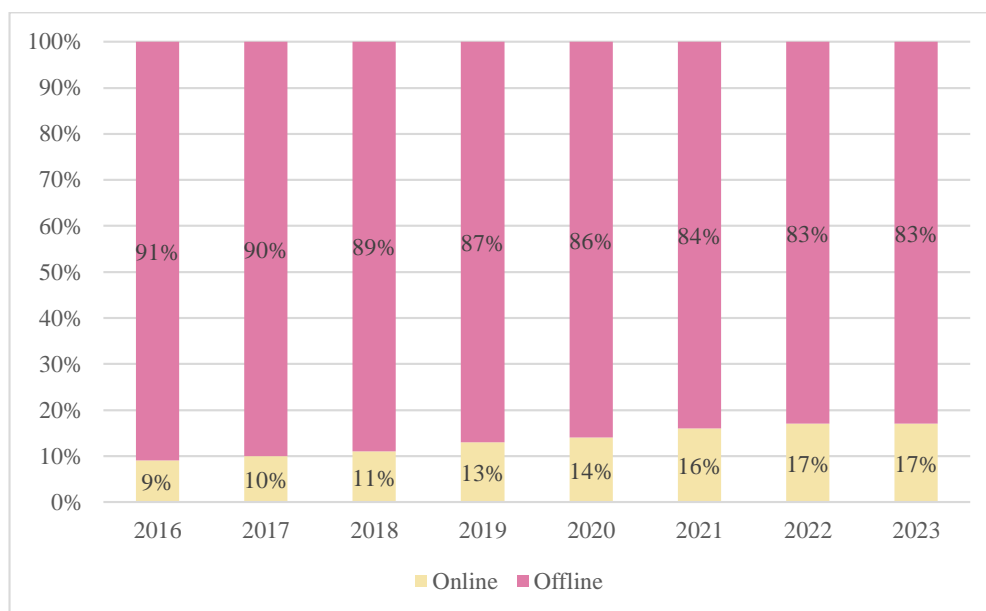


Figure 1.5 Sales Channels Percentage of Beauty and Personal Care in Indonesia
Source: (EU-Indonesia Business Network, 2019)

The advance of internet technology slides in to enhance customer's experiences to bridge the gap in the lack of direct experiential in online shopping. One technology that online retailers have been using to increase sales is virtual try-on (Zhang et al., 2019). Virtual try-on is the adaptation of augmented reality, the technology that aims to combine digital elements and real-world views for specific purpose. The user can try the products on website page or digital application with a camera-equipped device while they are using virtual try-on.. One of the examples of beauty industries that adopt virtual try-on technology is L'Oreal Paris. L'Oreal Paris' official website provides the feature by letting the users upload their self-portrait or use the live try-on, which recognize the users' face real-time. The interface can be seen in Figure 1.6. The selection of cosmetic ranges from eyebrow, blush, foundation, mascara, concealer, and lipstick.

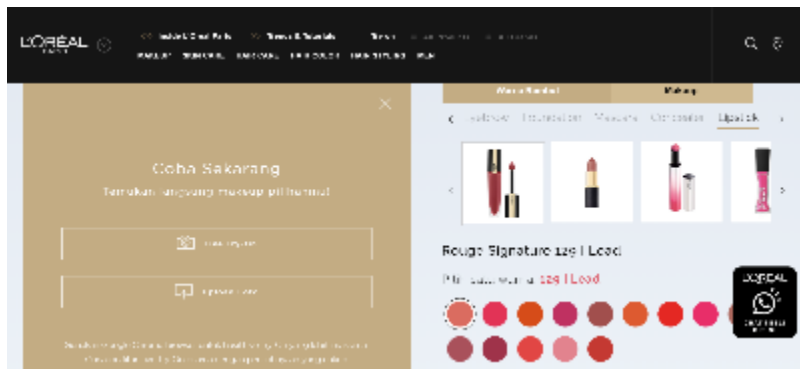


Figure 1.6 Virtual Try-On Feature in L'Oreal Paris Website

Source: L'Oreal Paris Indonesia Website

This research aims to provide a better experience for beauty consumers by developing a scoring system that will be combined with the function of virtual try-on technology. It lets the users try the cosmetic virtually and let the system gives the score from their selection based on the knowledge from the beauty experts, thus giving the recommendations of the product. This utilizes the case-based reasoning method. Case-based reasoning aims to solve new problems by utilizing the specific knowledge of previous problem situations instead of relying on general knowledge of a problem domain. In other words, case-based reasoning approach provides solutions to new problems by considering preceding experiences that still have relation to current situation (Zia et al., 2014). The application of case-based reasoning in this research is on how the users can automatically gain the score after virtually trying the cosmetic based on the knowledge from beauty influencers in types of look that the users chose in the beginning (Bold, Moderate, or Natural). The implementation of this study proposes a new powerful strategy to the cosmetic industry to increase the enjoyment of consumers and provide a better experience for the users.

1.2 Problem Formulation

Based on the background of this research, the problem that is formulated is designing the Virtual Beauty Advisor that combines virtual try-on function with the scoring system from case-based reasoning approach.

1.3 Research Objectives

The objectives of this research are listed below.

1. Capturing the knowledge from beauty experts regarding the make-up techniques and combinations.
2. Transforming the knowledge from beauty experts into case-based reasoning.
3. Designing the visualization of improvement called Virtual Beauty Advisor.

1.4 Research Benefits

The benefits that can be taken from this research are listed as follows.

1. The result can be taken as an improvement recommendation to beauty industries to provide better user experience and customer shopping enjoyment.
2. The consumers in beauty industries will have a faster decision-making process in deciding which products to buy through the improvement of the intimacy in the application that allows them to gain feedback from the experts.
3. The additional feature in the beauty advisor application will be expected to increase the generated sales from online channel.

1.5 Research Scope

The scope of this research is presented through the list of limitations and assumptions.

1.5.1 Limitation

1. This research uses L'Oreal Paris Indonesia brand as the standard of the cosmetic products selection
2. The products used as the combination of the scoring system are foundation, blush, eyebrow, eyeshadow, and lipstick from L'Oreal Paris.
3. The CBR cycle applied in this research is only until REUSE stage.

4. The development of the system in this research is done until user scenario.
5. The Virtual Beauty Advisor is meant specifically for women on age ranges from 21 to 23.

1.5.2 Assumption

1. The knowledge from the chosen beauty experts represents the knowledge of beauty experts in general.
2. The makeup style (bold/moderate/natural) is categorized based on the selected experts' signature makeup style.
3. The visualization of interface design from the proposed system represents the actual system.

1.6 Writing Structure

This subchapter explains about the writing system within this research. It covers 6 chapters; starting from the introduction until the conclusion and suggestion.

CHAPTER 1 INTRODUCTION

This chapter consists of the introduction of the research. The introduction covers the background that underlies the research, problem formulation that is going to be discussed, objectives that are aimed to be reached in this research, benefits that can be obtained from this research, the scope of this research that involves the limitation and assumption, and writing system used in this research.

CHAPTER 2 LITERATURE REVIEW

This chapter consists of theories from some terminologies that are used as the basis of this research. The literature came from books, journals, previous research, and other literature that support the basis and method of this research based on the problem formulation.

CHAPTER 3 METHODOLOGY

This chapter consists of the flow of doing this research. It involves the steps of each process of researching so that the research can be done systematically.

CHAPTER 4 KNOWLEDGE CAPTURING AND SYSTEM DEVELOPMENT

This chapter provides the process of capturing the knowledge and the process of transforming from tacit to explicit. The knowledge is then being associated with the scoring standard in the case-based reasoning system. The development of the Virtual Beauty Advisor design is also done in this chapter.

CHAPTER 5 ANALYSIS AND INTERPRETATION

This chapter presents the interpretation of the captured knowledge and the system that is developed. It also provides an analysis of the process that has been done. This chapter is used as the basis of the conclusion and suggestion.

CHAPTER 6 CONCLUSION AND SUGGESTION

This chapter consists of the final statements that conclude the overall research. This chapter also includes the suggestions for better upcoming research.

This page is intentionally left blank

CHAPTER 2

LITERATURE REVIEW

This chapter explains about the literature review used as the basis and supporting theories of this research.

2.1 Human Information Processing

Considering the universal function of computers that are no longer used for people on selected fields, human-computer interaction HCI began to rise as a critical instrument. Human-computer interaction is a field of study that focuses on the design of computer technology and the interaction between human (the users from individual or group) and computers. Human-computer interaction was initially a specialty area in computer science that embraces cognitive science and human factors engineering. The rise of these fields goes accordingly with the rise of the human information processing approach.

Human information processing is one of the scopes in cognitive ergonomics. This approach is based on the idea that human performance, from displayed information to response, is a function of several processing stages (Jacko, 2012). Human acts as the active processor of information. Human mind undergoes several steps to process information that can be depicted as the generic model of human information processing system. The generic model of Human Information Processing can be seen in Figure 2.1. There are 3 parts on human information processing; perceptual encoding, central processing, and responding. It started with the sensory that can be gained through all five senses of human body such as vision hearing, touch response, smell, or taste. The mind then makes a perception as an indicator of awareness toward the sensation. The process continues until responding stage where human makes execution toward the response.

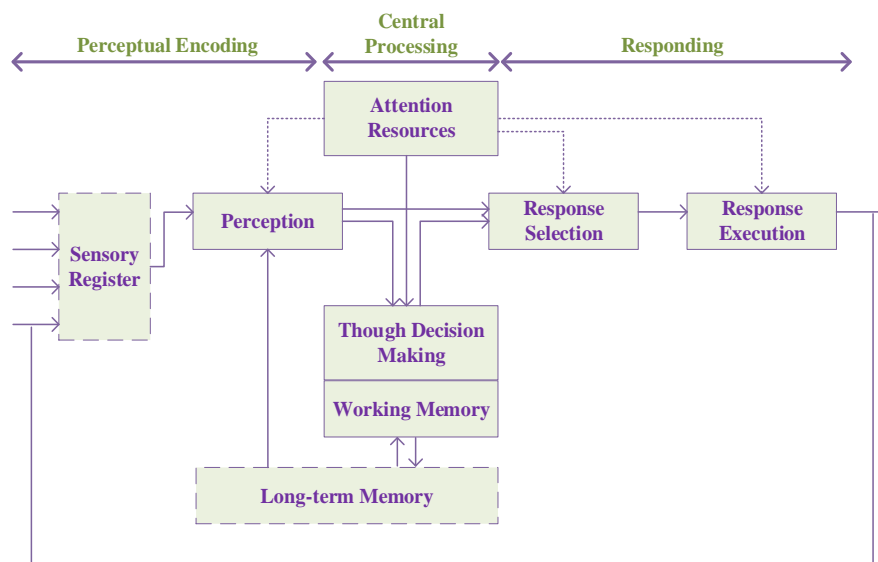


Figure 2.1 Generic Model of Human Information Processing

Source: Wickens et al. (2004)

2.2 Usability

What makes something usable is the absence of frustration in using it (Rubin & Chisnell, 2008). According to ISO (2018) about the ergonomics of human-system interaction, the objective of designing and evaluating systems, products, and services for usability is to help users achieve their goals effectively, efficiently, and with satisfaction. As per the explanation, it can be inferred that there are 3 (three) critical issues that embodied usability; effectiveness, efficiency, and satisfaction. Effectiveness deals with the accuracy and completeness of users in doing specified tasks to achieve specified goals. Efficiency deals with the utilization of the resource which leads to minimum efforts in achieving the results. Lastly, satisfaction deals with the emotion that users feel when using the systems, products, or services. That also includes the usability of interfaces from websites or applications.

Other points in usability attributes stated by Rubin & Chisnell (2008) in Handbook of Usability Testing are usefulness, learnability, and accessibility. Usefulness refers to the degree to which a product or system enables the users to achieve their goals. This measure is crucial because, despite the easiness of usage, learnability, and satisfaction, a product or system will not be used even if it is given away for free if it does not achieve specific goals. Learnability refers to user's

ability in terms of operating the product or system to some defined style of competence after some amount and period of training or even no time of training. It also covers the ability of infrequent users to relearn the system after inactivity periods. Accessibility is about how easy for users to have access to the product or system needed to accomplish a goal.

2.2.1 Usability Testing

Usability testing is the process of learning about users from users through observation using a product or system to accomplish specific goals of interest to them (Barnum, 2011). It is also used to evaluate the degree to which a product or system meets specific usability criteria. The testing is done by recruiting participants that are included as the representative of the target audience. The outcome of this process is that the product or system has minimum problems and frustrations experienced by the users. There are various ways to conduct usability testing as well as the various ways to evaluate the result of usability testing. Selecting the way to conduct the usability and the way to evaluate the result depends on the purpose of evaluation. There could be objective usability measures or subjective usability measures. Objective usability is used when the primary evaluation purpose is to increase productivity. The measures usually include the completion time of the task, successful completion rate of the scenario, and the time spent recovering from errors. On the other hand, subjective usability is used when the primary goal of the evaluation is user satisfaction. Ways of measuring subjective usability can be done through interviews, open questionnaires, or responses to standardized usability questionnaires such as PSSUQ.

2.2.2 Post Study Usability Questionnaire

Post Study Usability Questionnaire (PSSUQ) is a questionnaire designed to assess users' perceived satisfaction with the computer system or application (Sauro & Lewis, 2012). There are several versions of the questionnaire content, but the most recent one is the third version with 16 statement questions. PSSUQ allows the participants to tell the reactions toward the system that is being tested. Below are the statements that embodied the PSSUQ:

1. Overall, I am satisfied with how easy it is to use this system.
2. It was simple to use this system.
3. I was able to complete the tasks and scenarios quickly using this system.
4. I felt comfortable using this system.
5. It was easy to learn to use this system.
6. I believe I could become productive quickly using this system.
7. The system gave error messages that clearly told me how to fix problems.
8. Whenever I made a mistake using the system, I could recover easily and quickly.
9. The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.
10. It was easy to find the information I needed.
11. The information was effective in helping me complete the tasks and scenarios.
12. The organization of information on the system screens was clear.
13. The interface of this system was pleasant.
14. I liked using the interface of this system.
15. This system has all the functions and capabilities I expect it to have.
16. Overall, I am satisfied with this system.

The participants should rank each statement on a scale from 1 (strongly agree) to 7 (strongly disagree). The result of this questionnaire are formed as 4 scores; Overall Score, System Quality (SYSQUAL), Information Quality (INFOQUAL), and Interface Quality (INTQUAL). The overall score is the average of all responses from statement 1 to statement 16. SYSQUAL is the average of response from statement 1 to 6. INFOQUAL is the average of response from statement 7 to 12. Lastly, INTQUAL is the average of response from statement 13 to 15. The result of the score is then being evaluated. The best way to evaluate the result of PSSUQ is by comparing similar evaluations with similar products, tasks, and users. But, if the data are not available, the reference of comparison can be obtained through PSSUQ norms. Table 2.1 shows the norms of PSSUQ.

Table 2.1 PSSUQ Norms

No	Statement	Lower Limit	Mean	Upper Limit
1	Overall, I am satisfied with how easy it is to use this system.	2.6	2.85	3.09
2	It was simple to use this system.	2.45	2.69	2.93
3	I was able to complete the tasks and scenarios quickly using this system.	2.86	3.16	3.45
4	I felt comfortable using this system.	2.4	2.66	2.91
5	It was easy to learn to use this system.	2.07	2.27	2.48
6	I believe I could become productive quickly using this system.	2.54	2.86	3.17
7	The system gave error messages that clearly told me how to fix problems.	3.36	3.7	4.05
8	Whenever I made a mistake using the system, I could recover easily and quickly.	2.93	3.21	3.49
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.	2.65	2.96	3.27
10	It was easy to find the information I needed.	2.79	3.09	3.38
11	The information was effective in helping me complete the tasks and scenarios.	2.46	2.74	3.01
12	The organization of information on the system screens was clear.	2.41	2.66	2.92
13	The interface of this system was pleasant.	2.06	2.28	2.49
14	I liked using the interface of this system.	2.18	2.42	2.66
15	This system has all the functions and capabilities I expect it to have.	2.51	2.79	3.07
16	Overall, I am satisfied with this system.	2.55	2.82	3.09
	System Usefulness	2.57	2.8	3.02
	Information Quality	2.79	3.02	3.24
	Interface Quality	2.28	2.49	2.71
	OVERALL	2.62	2.82	3.02

Source: (Sauro & Lewis, 2012)

2.2.3 *Think Aloud*

Think Aloud is one of the methods in subjective usability measure that allows participants to express their feelings toward the product or system that is being tested. There are two identifications of think-aloud method; the concurrent think-aloud in which participants verbalize the thoughts during task execution and the retrospective think-aloud in which participants do so after task completion (McDonald et al., 2012). There are several benefits gained from using think-aloud method as the subjective evaluation. Think-aloud does not need any devices, it is also flexible and trustworthy because it comes straight from the opinion of the participants. It is also easy to be understood. But, several drawbacks could be brought by think-aloud method. One of them is the unnatural situation because the participants are forced to talk and express their feelings one-way although the moderator is there with the participants.

2.3 **Augmented Reality**

Augmented reality (AR) is one of the developments in human-computer interaction technology that combines virtual world and real world. The reason why AR is developed under human-computer interaction is that AR bridges both worlds by adding layers of digital elements such as virtual objects, animations, and images into real-world views for specific purposes. It has 3 (three) key requirements; combining real-virtual content, interactive in real-time, and registered in 3D. There are many types of AR based on its display technology, tracking technologies, and tracking types. The implementation of AR technology has been cuffed into several fields, such as education, entertainment, and marketing. In the marketing field, AR technology can be used to create experiences that are more memorable than other more traditional forms of marketing (Billinghurst et al., 2015). Using AR technology as tools to visualize the products enable consumers to experience products in novel ways. One of the examples of AR technology in marketing is in IKEA, where users can virtually place IKEA products on the display of their real home. Another example is Modiface Make-up that allows users to try cosmetic products by having their face tracked and recognized in precise detail. The said examples such as object-placing and virtual try-on are considered as marker-less

tracking types in AR. Generally, there are two types of tracking types in AR; marker-based and marker-less. Marker-based tracking utilizes marker as a trigger to display the virtual objects, while marker-less tracking does not require any marker. Instead, marker-less tracking uses some types of localization technology, such as Global Positioning System (GPS), Radio Frequency Identification (RFID), and sensor technology to control the relative position relationship between virtual and real worlds (Cheng et al., 2017).

2.4 Knowledge Management

Knowledge is a familiarity, awareness, or understanding of something, such as a person, facts, information, or skills that are obtained through experience or education by perceiving and learning. It is a tool that can only be effective in the hands of people with good intentions and by proper utilization. Knowledge management exists as the process of using knowledge properly. It consists of capturing, distributing, and effectively using knowledge (Davenport, 1994). One of the basic models of knowledge management is developed by Nonaka & Takeuchi (1996) and is called SECI Model. SECI is known as one of the models that can represent the conversion of knowledge, whether it is from tacit to explicit or the other way around (Markopoulos & Kornilakis, 2016). Tacit refers to the knowledge that is undocumented and usually being transferred by verbalizing the knowledge. It comes from the experience of an individual that stays in the mind. Therefore, tacit knowledge is personal and can be expressed hardly. As opposed to tacit knowledge, explicit knowledge is theories that are easily transferrable to other people because it can be documented and shared in the forms of writing, audio, video, image, software, and database.

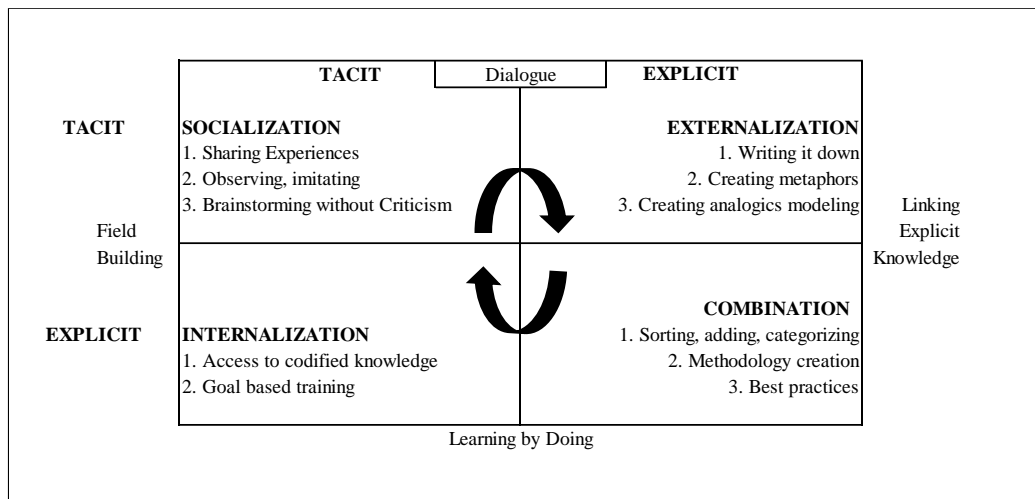


Figure 2.2 The Nonaka-Takeuchi SECI Knowledge Management Model

Source: (Markopoulos & Kornilakis, 2016)

The Nonaka-Takeuchi SECI Model has four types of conversion for tacit and explicit knowledge:

1. **Socialization:** Socialization is an interpersonal process that converses knowledge from tacit to tacit. Since tacit knowledge is transferred verbally, this state is about individuals attempts to share the knowledge through having interactions with other people. It occurs when the hidden knowledge of one's mind is transferred to others' minds in a hidden knowledge form (Radgah & Faghihi, 2015).
2. **Externalization:** Externalization is the conversion of tacit knowledge to explicit knowledge. It is done by codifying unwritten experience and insight of tacit knowledge to written and compiled knowledge that can be used and accessible in the long term. The example of externalization is when face-to-face contact leads to the share of beliefs that will later be learned and articulated better in such written theories.
3. **Combination:** Combination occurs when the conversion happens from explicit knowledge to explicit knowledge. This broadly opens the probability of explicit knowledge development such as scientific texts, databases, and statistics, since combination aims to combine the existing explicit knowledge to make the new form of another explicit knowledge.

4. **Internalization:** Internalization is the conversion of explicit knowledge to tacit knowledge. This is meant by comprehending the explicit knowledge in order to extend and revise an individual's tacit knowledge.

Those four steps from socialization to internalization goes continuously in a snail-form move so that each phase completes its previous phases internalizing knowledge in organizations and generating new kinds of knowledge (Radgah & Faghihi, 2015).

2.5 Case-Based Reasoning

Case-based reasoning (CBR) is a problem-solving approach that utilizes the memory of previous similar situations and reusing information and knowledge of those situations to be applied to the new problems. CBR is applicable in almost every field of work, such as physician with the diagnosis and treatment from the previous patients to diagnose new patient, an engineer who recalls the critical measurement memory of previous blow-out situations to handle new blow-out situation or financial consultant that uses a reminding to previous credit decision task to recommend the loan application troubles to new client. In CBR terminology, a case indicates a problem situation and previously experienced situation, which has been captured and learned in a way that it can be reused in the future problem's solving, is referred to as past case, previous case, stored case, or retained case (Aamodt & Plaza, 1996). Those two will undergo a cyclic and integrated process to solve problems and learn from the experience. The cycle can be described by four processes:

1. **RETRIEVE:** To retrieve the most similar cases
2. **REUSE:** To reuse the information and knowledge in the retrieved case
3. **REVISE:** To revise the proposed solution
4. **RETAIN:** To retain the parts of this experience likely to be useful for future problem solving

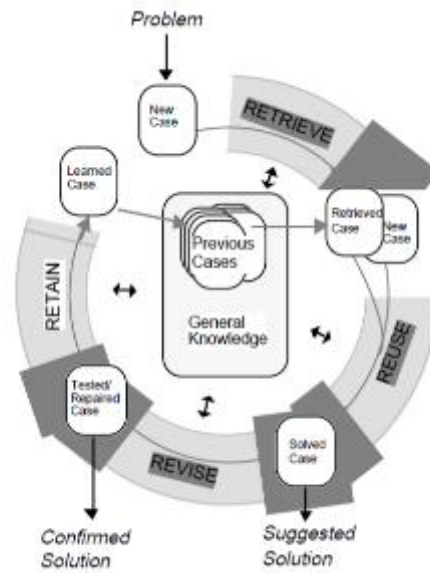


Figure 2.3 The CBR Cycle

Source: (Aamodt & Plaza, 1994)

The initial description of the problem indicates a new case which will be used to *retrieve* a case from the collection of previous cases in the center. Then, the retrieved case is being *reused* with combination from the new case in order to be a solved case, a proposed solution to the initial problem. The solution is then being tested for success through the *revise* process. Lastly, the useful experience is retained for future use in *retain* process. The similarity of new problem and the cases need to be calculated to find the most similar case as the solution to new case. The formula is shown in Equation (2.1).

$$Similarity (problem, case) = \frac{1}{\sum_{i=1}^n w_i} \sum w_i \times s_i \quad (2.1)$$

Where;

w_i = Weight of the feature

s_i = Similarity value

Several features are needed to be assessed in each problem. Each feature is being weighted by the expert. There are only two types of features: very important features and less important features. Very important feature weighs as 6 and less important feature weighs as 1. The similarity value ranges from 0 to 1 and depends

on the difference of the condition between the feature in new problem and old case. The case is eligible to be the solution to the new problem if the similarity yields closer to 1.

2.6 L'Oreal Paris Website

Several brands or companies have already adopted augmented reality technology as Virtual Try-On features, such as NYX, Sephora, and Maybelline. However, this research uses L'Oreal Paris brand as the base of scoring system development because the website is based on the Indonesian branch company, which provides the products that are available for sale in Indonesia. Besides L'Oreal Paris Indonesia, Maybelline Indonesia has also adopted this technology, but the product selection is very limited compared to L'Oreal Paris.

L'Oreal Paris Website is an official website of L'Oreal Paris brand, a French-based cosmetic brand that sells a wide range of beauty and personal care. On the website, L'Oreal Paris showcases the catalog of the products with categorization, such as cosmetics, skincare, haircare, hair color, and hairstyling. When the user clicks to see the display of the product, the website provides all the information that the user may need. The information consists of product visualization, price, description, and ingredients. Users can also give the review and rating for products that they have already tried. Besides the product catalogs, the website also provides "Inside L'Oreal Paris" section that consists of upcoming and on-going projects, campaigns and advertisements of L'Oreal Paris. Another section provided by this website is "Trends & Tutorial" that consists of editorial articles about current beauty trends and tips on using L'Oreal Paris products. Lastly, the website also provides a "Virtual Try-On" feature.

Virtual Try-On is a technology that creates and manipulates virtual product or environment images to simulate real experience so the users can virtually interact with the product. This technology adds shopping value from the utilitarian perspective by addressing the suit, fit and match dilemma, also the hedonic value through pleasure and enjoyment experienced by consumers while interacting with virtual try-on (Zhang et al., 2019). L'Oreal Paris website features this technology to provide the users with experience of trying the cosmetic through facial

Table 2.2 Research Roadmap

No	Author	Year	Title	Findings
1	Waqar, M. et al.	2013	Wearable Item Suggestion System using Case-based Reasoning	Development of wearable item suggestion system for suggesting the cosmetic, hairstyle, eyewear, contact lenses, dress, etc. for various occasions. Utilizes the knowledge of experts in each sector to recommend the products that should be used based on users' needs.
2	Gupta, A. et al.	2013	Online Shopping: A Shining Future	Highlights the opportunity of online shopping in the future by showcasing the upside and downside of the online shopping. Technology becomes one of the most tremendous aspects that can be relied on for allowing easier and more realistic shopping experience.
3	Rauschnabel, P. et al.	2019	Augmented Reality Marketing: How Mobile AR-apps Can Improve Brands through Inspiration	Finds that AR technology is a promising field in marketing practice and gives significant improvement in brand attitude.

No	Author	Year	Title	Findings
4	Zhang, T. et al.	2019	The Role of Virtual Try-On Technology in Online Purchase Decision from Consumers' Aspect	Finds that the customers' attitude towards virtual try-on technology can affect their intention to do the online purchase, confirms the previous theory that interactive technologies applied to shopping experience can lead to stronger purchase intention.
5	Sabhira, A. R.	2020	Development of Scoring System using Case-based Reasoning in Virtual Beauty Advisor Application	Development of scoring system using case-based reasoning to be applied in beauty virtual try-on technology to improve cosmetic shopping experience by transferring the knowledge from beauty expert.

Source: Personal Documentation

CHAPTER 3

RESEARCH METHODOLOGY

This chapter consists of the explanation of methodology used in the conduction of this research that is constructed according to research framework.

3.1 Research Flowchart

In this subchapter, the flowchart of this research is preserved. There are 4 stages in this flowchart (preliminary, knowledge exploration & system development, analysis & interpretation, and conclusion).

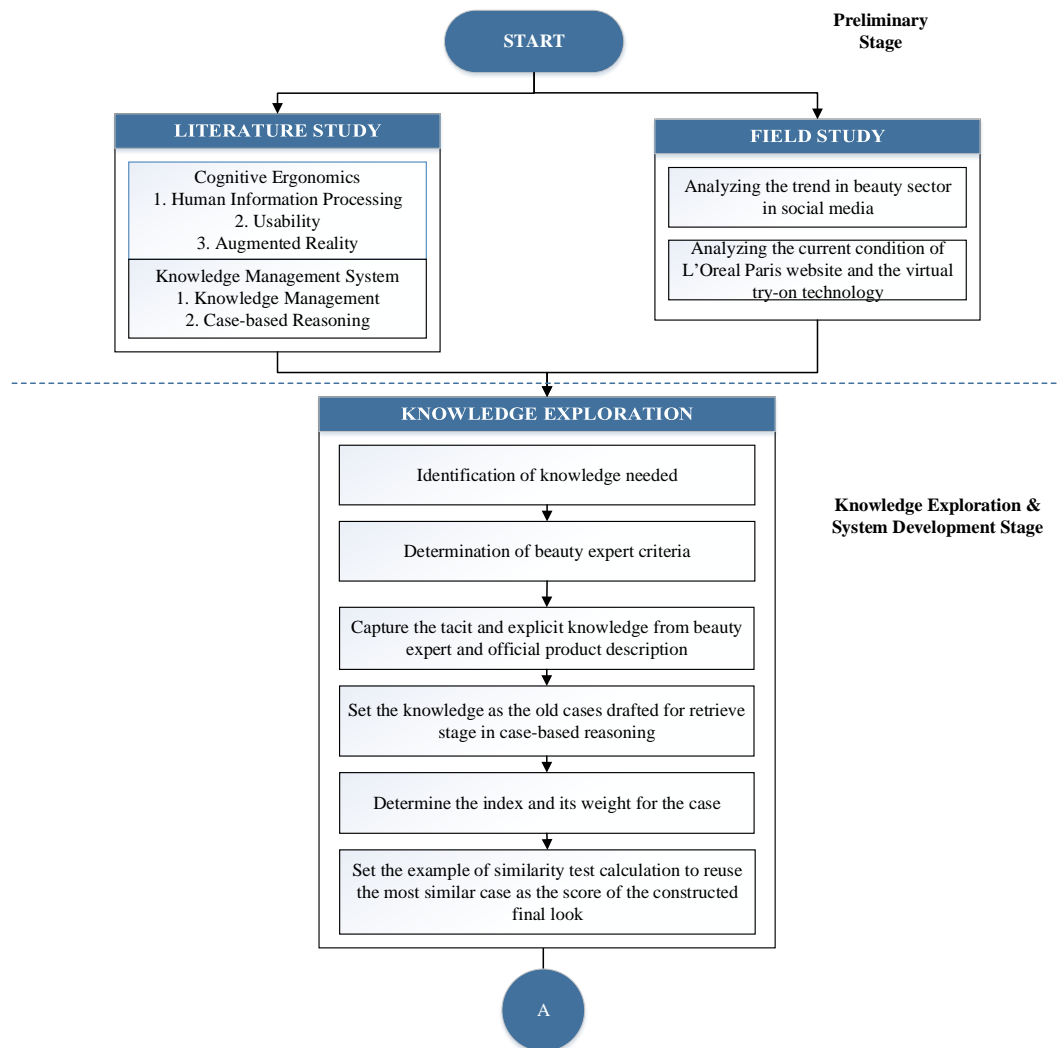


Figure 3.1 Research Flowchart

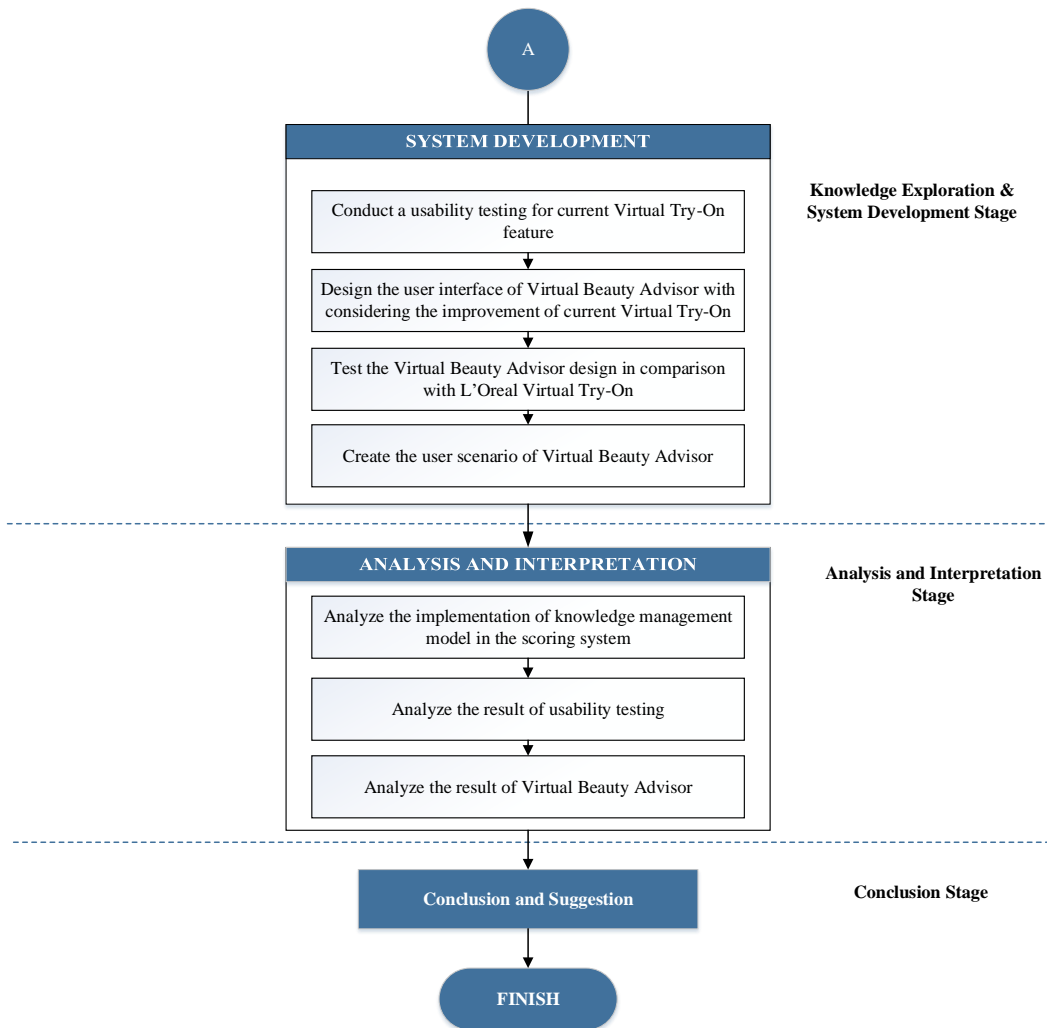


Figure 3.2 Research Flowchart (continued)

3.2 Preliminary Stage

Preliminary stage is the initial stage where the study is conducted to gain comprehension about the problem that will be solved through this research. Both literature study and field study is done to find the gap between the real condition and the theories.

3.2.1 Literature Study

Literature study is the study to get the comprehensive understanding about theories that support the flow of this research. Literature study of this research

consists of two areas of discipline; cognitive ergonomics and knowledge management systems. In cognitive ergonomics, theories that are studied as supporting facts are human information processing, usability, and augmented reality. While in knowledge management system, there are knowledge management and case-based reasoning.

3.2.2 Field Study

In field study, this research evaluates the current condition of L'Oreal Paris website to see the products showcased through Virtual Try-On technology and the existing flow of information preserved through the website. This research also sees the trend of beauty in the digital platform to see how beauty expert engages with the viewers while seeking on the tutorial or review of make-up styles or occasions that are highly requested from the viewers.

3.3 Knowledge Exploration and System Development Stage

This stage consists of the flow of knowledge capturing and the process of transforming the knowledge until it becomes drafted cases to be retrieved in case-based reasoning system.

3.3.1 Knowledge Exploration

Knowledge exploration is the step where tacit and explicit knowledge are being captured and conversed based on knowledge management cycle. This starts with the identification of experts used in this research, identification of the knowledge needed for the system, until the implementation of case-based reasoning as the basic of the scoring system.

3.3.1.1 Determination of Expert Criteria

The main component that builds the scoring system is the knowledge from the experts. There are two kinds of experts used in this research; beauty influencers and make-up artist. The use of beauty influencers as the basis of the knowledge standard is because this research utilizes the tendency of cosmetic users that majorly rely on beauty influencers' preferences.

The criteria used for the beauty influencers are:

1. Based on Indonesia
2. Routinely create beauty related content on social media
3. Has a strong personal style on make-up (Bold/Moderate/Natural)



Beauty influencers used in this research are categorized based on their personal style of make-up. There are 3 categories for make-up styles; bold, moderate, and natural. The explanation of each category is explained as follows.

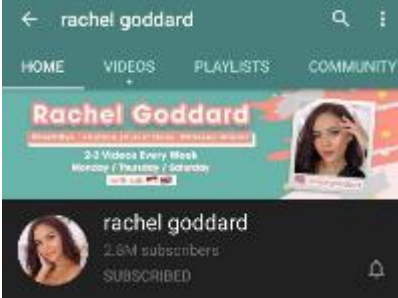
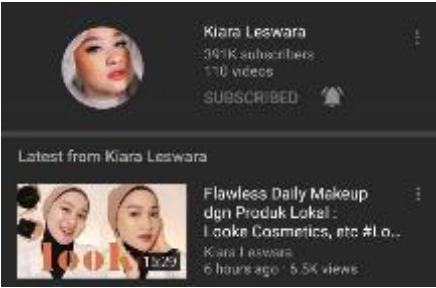
- **Bold:** A make-up style that shows detectable differences on face compared to a person's natural bare face which accentuates playful colors on eyes and lips.
- **Moderate:** A make-up style that still shows detectable differences on face but plays with soft colors on eyes and lips.
- **Natural:** A make-up style that does not aim to show detectable differences on face compared to a person's natural bare face.

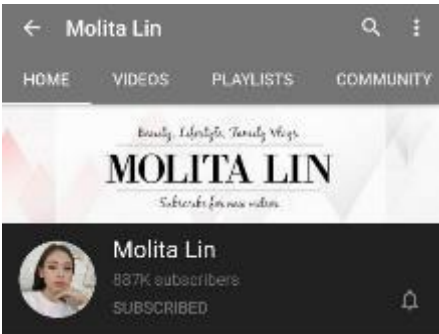
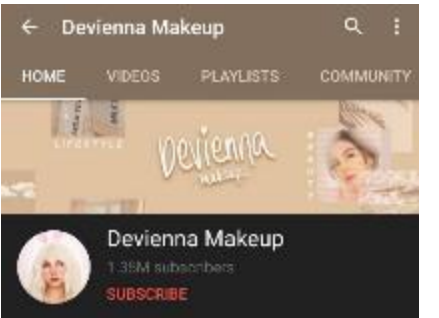
For each make-up style, there will be 2 beauty influencers used.

Table 3.1 shows the beauty influencers used for this research.

Table 3.1 List of Beauty Influencers

No	Name	Description	Make-up Style
1	<p>Tasya Farasya</p> 	<p>Tasya Farasya is a beauty content creator who previously was a make-up artist. She consistently uploads beauty related contents and videos on Youtube and Instagram. She often released cosmetic products in collaboration with various cosmetic brands. Well-known as beauty content creator with heavy make-up and bold signature style.</p>	<p>Bold</p>
2	<p>Lifni Sanders</p> 	<p>Lifni Sanders is a beauty content creator who regularly uploads the video on Youtube. She is well-known as the content creator who loves to voice out the inclusivity that should have been owned by local brand's products, especially in foundation color. She often do reviews of various cosmetic products from various brands. She is well known for the bold signature style.</p>	<p>Bold</p>
3	<p>Rachel Goddard</p>		<p>Moderate</p>

No	Name	Description	Make-up Style
		<p>Rachel Goddard is a beauty content creator who regularly uploads video on Youtube and Instagram. She is well known for her comedy infused content while doing make-up reviews or tutorials. She delivers the tutorial and product reviews. She also did the collaborations with cosmetic brands several times. She accentuates the signature style of natural-glam make-up which falls in the category of moderate style in this research.</p>	
4	<p style="text-align: center;">Kiara Leswara</p> 	<p>Kiara Leswara is a beauty content creator who regularly uploads video on Youtube and Instagram. She was frequently trusted as the brand ambassador of various cosmetic brands, also did the collaborations for beauty products. She represents the young people with daily life content and she has natural glam signature style.</p>	Moderate
5	Molita Lin		Natural

No	Name	Description	Make-up Style
	 <p>The image shows the YouTube channel page for Molita Lin. At the top, there is a navigation bar with 'HOME', 'VIDEOS', 'PLAYLISTS', and 'COMMUNITY'. Below that is a banner with the text 'Beauty, Lifestyle, Family Vlogs' and 'MOLITA LIN' in large letters, with 'Subscribe for new videos' underneath. At the bottom, there is a profile picture of Molita Lin, her name 'Molita Lin', '887K subscribers', and a 'SUBSCRIBED' button.</p>	<p>Molita Lin is a beauty content creator who regularly uploads video on Youtube and Instagram. She is well-known for natural make-up look and Korean-inspired look. She did collaborations with various brands multiple times for cosmetic products.</p>	
6	<p style="text-align: center;">Devienna</p>  <p>The image shows the YouTube channel page for Devienna Makeup. At the top, there is a navigation bar with 'HOME', 'VIDEOS', 'PLAYLISTS', and 'COMMUNITY'. Below that is a banner with the text 'LIFESTYLE' and 'devienna MAKEUP' in a stylized font, with a profile picture of Devienna. At the bottom, there is a profile picture of Devienna, her name 'Devienna Makeup', '1.35M subscribers', and a 'SUBSCRIBE' button.</p>	<p>Devienna is a beauty content creator who regularly uploads video on Youtube. Although she likes to experiment with editorial make-up look, she is still known for the natural signature style. She also did collaborations with various brands for cosmetic products.</p>	Natural

Another beauty expert used for this research comes from the profession of make-up artist. The reason of having two kinds of beauty expert is because the knowledge gained from beauty influencers are limited on the content of the video in Instagram and Youtube. So, a professional make-up artist whom already experienced in doing other people's make-up will complete this system to cover the needs of various skin condition and skin tone from the users. The make-up artist expert used in this research is Nedita Farah, a certified make-up artist whose clients are diverse enough to have experiences in doing make-up on various skin conditions and skin tones. Figure 3.3 shows the profile of the make-up artist on social media platform.



Figure 3.3 Selected Make-up Artist

3.3.1.2 Identification of Knowledge Needed

Besides the expert criteria determination, the types of knowledge that will be recorded is also essential as the input of the system. The types of knowledge that will be recorded are listed in Table 3.2.

Table 3.2 Types of Knowledge

PRODUCT CATEGORY	No	TYPES OF KNOWLEDGE
FOUNDATION	K1.1	Choosing foundation based on make-up style

PRODUCT CATEGORY	No	TYPES OF KNOWLEDGE
	K1.2	Choosing foundation based on skin condition
	K1.3	Choosing foundation based on skin tone
BLUSH	K2.1	Choosing blush-on based on skin tone
LIPSTICK	K3.1	Choosing lipstick based on make-up style
	K3.2	Choosing lipstick shade based on skin tone
EYESHADOW	K3.3	Choosing eyeshadow color based on make-up style
	K3.4	Choosing eyeshadow color based on skin tone
EYEBROW	K3.5	Choosing eyebrow product based on make-up style

The identification of knowledge needed for the scoring system is adjusted with the product selection in L’Oreal Paris Virtual Try-On feature. In this research, the products used are limited on the foundation, blush, lipstick, eyeshadow, and eyebrow. Through the identification of the knowledge needed, it can be seen that the scoring system will be varied for different make-up style, skin condition, and skin tone. Therefore, the user of this system shall give the input for the system regarding the desired make-up style, skin condition, and skin tone. The constructed user input that is classified in Table 3.3.

Table 3.3 Classification of User Input

CATEGORY	OPTIONS
Make-up Style	Bold (for party occasion)
	Moderate (for hangout, work, or casual activity)
	Natural (for school or college)
Skin Condition	Normal skin
	Dry skin
	Oily skin

CATEGORY	OPTIONS
	Combination skin
Skin Tone	Light
	Medium
	Tan

There are 3 categories of user input; make-up style, skin condition, and skin tone. Make-up style category is needed to precisely score the make-up look of the users based on users' personal preference of style. The classification of make-up style consists of bold style, moderate style, and natural style. This classification will be portrayed by selected beauty influencers that are well-known for their personal style on make-up. Besides make-up style, there are skin condition and skin tone. Skin condition is crucial because in deciding which make-up to buy, consumers are also concerned about the formula and texture of the product that will get along well on their skin. The last category is skin tone. This is just as crucial as skin condition because not every shade of products gets along with every skin tone. The knowledge can be captured and conversed as the score that will be gained by users in the Virtual Beauty Advisor after the expert, knowledge types, and the user input are already determined,. Table 3.4 shows the example of knowledge conversion that will be generated with the Virtual Beauty Advisor system.

Table 3.4 Example of Knowledge Conversion

No	User Input	Product	Expert Knowledge	Product Recommendation
1	Moderate make-up style	Foundation	The foundation used should be light-wearing and not too full coverage. For dry skin, it is better to use the foundation with dewy finish.	1. Infallible Fresh Wear Foundation (High)
	Dry skin			2. True Match Lumi Cushion Foundation (High)
	Light skin tone			3. True Match Liquid Foundation (Normal)
				4. Infallible Pro-Matte Foundation (Low)

In the example of knowledge conversion, the knowledge that is mined is how to choose the foundation based on occasion and skin condition. The verdict from the expert is given in Expert Knowledge column. From the expert, it can be inferred that Moderate make-up requires less coverage type of foundation with a lightweight formula. Then, the knowledge from experts is being translated to each foundation product to be ranked from high-to-low. If the user chooses Infallible Pro-Matte Foundation, the user will have low score in foundation sector.

Explicit knowledge is also recorded by collecting the information and product description from the official website of L’Oreal Paris. After all the knowledge are recorded, the SECI model is involved due to the process of transferring tacit-to-explicit knowledge and explicit-to-explicit knowledge. The result will be the main input to the scoring system as the basis of the cases to be retrieved in case-based reasoning.

3.3.2 Case-based Reasoning

After obtaining the knowledge, the knowledge was drafted as old cases that can be retrieved in the Case-based Reasoning (CBR) cycle. The cycle of CBR is depicted on Figure 3.4 from retrieve to reuse stage. New problem enters the system as user fills in the input. Then, the retrieval is done to recall the old cases from the knowledge of beauty expert. The similarity is calculated to find which case has the biggest value of similarity and the score is generated based on selected case.

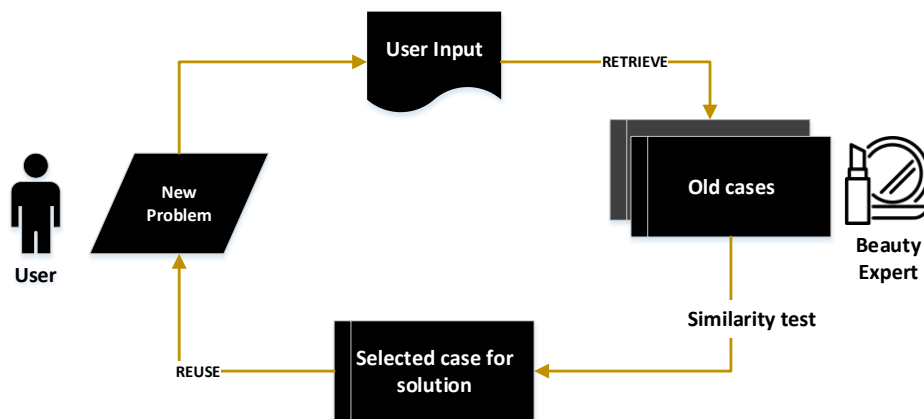


Figure 3.4 CBR Cycle of Proposed System

3.3.3 *System Development*

This step is done to visualize the improvement proposed by this research. It starts with conducting the usability testing of current L’Oreal Paris Virtual Try-On feature. This is done to evaluate the satisfaction of the user in the current condition. The feedback and recommendations from the participants involved in usability testing will be used for the improvement in the proposed Virtual Beauty Advisor. After conducting the usability testing, the next step is designing the Virtual Beauty Advisor. The final step is building the user scenario to showcase the process flow of Virtual Beauty Advisor.

3.3.3.1 *Usability Testing*

The objectives of usability testing should be defined before the testing is conducted. The objectives from conducting usability testing in current L’Oreal Paris Virtual Try-On feature is to test the satisfaction of the users and see whether Try-On feature is helpful enough for users to decide which make-up product is suitable for them. Various metrics can be used for the measurement in usability testing. However, this research only uses satisfaction metric because it is related with users’ creativity to construct the desired final look. The satisfaction is measured using a standardized usability questionnaire called PSSUQ (Post-Study System Usability Questionnaire).

Usability testing requires several respondents to try the feature with specified tasks and scenarios. In this research, the criteria for the participants involved in usability testing were:

- Gender: Woman
- Age: Ranges between 20 until 25-year-old
- Periodically or routinely using make-up

The selected participants were given the tasks and scenario. The tasks given to the participants were to open the L’Oreal Paris Website, use the Virtual Try-On feature, and create the final make-up look using the Virtual Try-On feature. This task is based on participants’ creativity and desire, so the completion time is neglected. Participants are obliged to do think-aloud about all of their feelings toward the

feature during the test. Due to the limitation of the situation, usability testing was conducted via virtual meeting. The participants were allowed to share the screen that displays their experience of using Virtual Try-On.

The participants were asked to fill out the PSSUQ to measure the satisfaction of the experience throughout the process after the testing is completed. PSSUQ is a standardized usability questionnaire that consists of 16 statements. Participants are obliged to rate each statement on a scale 1 (Strongly Agree) to 7 (Strongly Disagree). Participants were also required to fill the open questions that enabled them to give feedback and recommendations for future improvement. The questions given to the participants were:

1. How is the participant's overall impression of the Virtual Try-On feature?
2. What is the best thing from the Virtual Try-On feature?
3. What is the worst thing from the Virtual Try-On feature?
4. Does the participant feel that Virtual Try-On feature helps in deciding which product is suitable? Why?
5. What are the recommendations that the participant can give to improve the Virtual Try-On feature?

The feedback and recommendations gained from the usability testing and open questionnaire are taken as improvements to build the Virtual Beauty Advisor design. Then, the design of Virtual Beauty Advisor was made by considering the main important parts from user input and the recommendations from participants. The Virtual Beauty Advisor design was presented to the same usability testing participants to know whether the improvement is better than the current Virtual Try-On feature on L'Oreal Paris. The participants were asked to fill the second questionnaire. This second questionnaire allowed participants to rank the main additional features on Virtual Beauty Advisor from a scale 1 (Strongly Dissatisfied) to 5 (Strongly Satisfied). The main additional features are; the options to choose the preferred makeup style, the options to choose skin condition, the options to choose skin tone, and the result of scoring system. It was also completed with open questionnaire to record the recommendations from participants.

3.4 Analysis and Interpretation Stage

This stage consists of the analysis of data processing done in the previous stages. It starts with the analysis of knowledge exploration and case-based reasoning stage, followed by the analysis of usability testing result, and finished with the analysis of the result of Virtual Beauty Advisor design.

3.5 Conclusion and Suggestion Stage

This stage consists of the conclusion that can be inferred through the data processing and analysis stage. The conclusion should be based on the objectives stated on this research. From the conclusion inferred, the suggestion can be given for the brand and upcoming research.

CHAPTER 4

KNOWLEDGE EXPLORATION AND SYSTEM DEVELOPMENT

This chapter presents the knowledge exploration and the implementation of case-based reasoning that builds the scoring system for Virtual Beauty Advisor.

4.1 General Overview of L’Oreal Paris Virtual Try-On Feature

Virtual Try-On is one of the features that can be utilized in L’Oreal Paris Indonesia official website. This feature allows the user to try the products real-time using live try-on that relates to web camera from users’ electronic devices or just simply upload the picture of user’s bare face. The products vary from foundation, concealer, lipstick, blush, mascara, and eyebrow. Figure 4.1 shows the interface of Virtual Try-On feature.

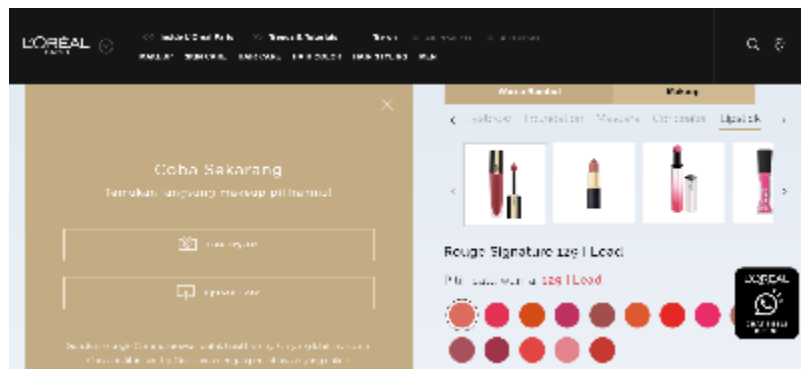


Figure 4.1 Interface of Virtual Try-On Feature

Source: www.loreal-paris.co.id

This feature allows the user to try the combination of products so that the result can be completed as one final look. User can also see the comparison of their face with or without the make-up. This will let user see the difference that those products give to their faces. The final look can be saved in the form of picture after the user completes the virtual try-on.



Figure 4.2 Comparison of User's Face With and Without Make-up

Source: www.loreal-paris.co.id

This feature gives novelty experience of shopping online by allowing users to see how the product fits their faces without actually using the product. However, cosmetic products are considered as personal because it has linkages with personal skin condition and skin tone when applied. Those personal situations cannot be covered by virtual try-on feature. Therefore, this research proposes an improvement to Virtual Try-On Feature by adding scoring system that enables user to gain real-time feedback based on the tacit and explicit knowledge from beauty expert with the consideration of reckoning the dependencies of cosmetic consumers for the preference of beauty expert. This improvement is named by Virtual Beauty Advisor since it replaces the role of beauty advisor that can give feedback or recommendations directly to the users. Since the improvement will score user's final look from the combination of L'Oreal Paris products, the knowledge captured from beauty expert will be limited based on L'Oreal Paris product selections.

4.2 Knowledge Exploration

This subchapter is detailing about the exploration and documentation of tacit and explicit knowledge starting from the identification to the case drafting as the standard of old cases for the case-based reasoning system.

4.2.1 Identification of Knowledge Needs

In this research, the knowledge required for building the case-based reasoning scoring system are based on the product category selections of L’Oreal Paris brand. There are foundation, blush, eyeshadow, eyebrow, and lipstick. Tacit and explicit knowledge are needed to determine the suitability of each product for various make-up looks, skin conditions, and skin tones. There are 3 kinds of make-up look, 4 kinds of skin condition, and 3 kinds of skin tones. The types of knowledge captured for the scoring system are shown in Table 3.2. Every category of product needs to be adjusted based on each skin color and make-up style. For foundation category, it also needs to be adjusted based on skin conditions since each product has different formula and finish. There are 10 products with 55 color shades in total that can be combined by the users to create the finished make-up looks. The knowledge from the expert were captured and translated as the rank of each product in each scenario; from the highest score to the lowest score.

4.2.2 Knowledge Capturing

This step was done to capture the tacit knowledge and documenting the explicit knowledge to be used as the standard of the scoring system. Tacit knowledge is gained from beauty experts. In this research, there were two types of beauty expert used; beauty influencers and make-up artist. The knowledge captured from beauty influencers were obtained through the video content uploaded on Youtube. Table 4.1 shows the example of knowledge capturing through beauty influencers.

Table 4.1 Example of Knowledge Capturing from Beauty Influencers

No.	Knowledge Result	Source	Link
BOLD MAKE-UP STYLE			
K1.1	Foundation needs to be medium to high coverage	Tasya Farasya	https://youtu.be/gN0qHaX2yp0

No.	Knowledge Result	Source	Link
K1.2	L'Oreal True Match Foundation has perfect bold look finish	Lifni Sanders	https://youtu.be/luNAMXmbT5s
MODERATE MAKE-UP STYLE			
K1.3	L'Oreal Infallible Pro-Matte Foundation shade 101 is suitable for light skin	Kiara Leswara	https://youtu.be/8RkK0uknctM
K2.1	Blush with dark red colour is suitable for tan skin	Rachel Goddard	https://youtu.be/fokVAgMhJpQ
NATURAL MAKE-UP STYLE			
K3.1	Lipstick with light texture is suitable for natural make-up	Devienna	https://youtu.be/tQksPIUzQOU
K3.2	Light coloured lipstick is suitable for light skin	Molita Lin	https://youtu.be/EfDxbkWU_4Q

The other process to capture the knowledge from the second type of expert was by conducting an interview and giving questionnaire to the expert. The questionnaire consists of questions regarding the type of foundation, blush, eyeshadow, lipstick, and eyebrow for 3 different make-up style (Bold/Moderate/Natural), 3 different skin tones (light/medium/tan), and 4 skin conditions (normal/dry/oily/combination). With every combination of products in each skin tone and skin condition, the expert should give the score that ranges from

High (perfect look), Normal, and Low (poor look). Figure 4.3 shows the example of question in expert questionnaire, specifically in foundation category.

Untuk makeup level yang HEAVY (cocoklah untuk acara pesta/wedding event, wisuda, dll), sesuaikan *
 Use foundation dibawah ini berdasarkan score HIGHNORMALLOW

	High	Normal	Low
Full Coverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medium Coverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sheer Coverage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thick formula	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lightweight formula	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Matte finish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dewy finish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 4.3 The Example of Question in Expert Questionnaire

This stage also captured the explicit knowledge. The explicit knowledge were obtained from the description of the products on the official website to clarify the characteristic of each product ranked by the expert. For example, if the expert thinks that people with oily skin should use foundation that has creamy consistency and matte finish, it will be best for them to use L’Oreal Infallible Pro-Matte Foundation because it has creamy consistency and matte finish based on the description of the product. Table 4.2 shows the curated descriptions of each product as the current explicit knowledge.

Table 4.2 Curated Product Descriptions

No	Category	Product Name	Description
1	Foundation	L'Oreal Infallible Pro-Matte Foundation	<ol style="list-style-type: none"> 1. 24 hours longevity 2. Creamy texture 3. Matte finish 4. Medium to full coverage
2		L'Oreal Infallible 24H Liquid Foundation	<ol style="list-style-type: none"> 1. 24 hours longevity 2. Liquid texture 3. Natural dewy finish 4. Medium to full coverage
3		L'Oreal True Match Liquid Foundation	<ol style="list-style-type: none"> 1. Creamy texture 2. Natural dewy finish 3. Light to medium coverage
4		L'Oreal True Match Cushion Foundation	<ol style="list-style-type: none"> 1. 14 hours longevity 2. Liquid texture 3. Natural matte finish 4. Light to medium coverage
5	Blush	Le Bar a Blush	<ol style="list-style-type: none"> 1. Powder texture 2. Natural shimmer finish
6	Eyebrow	Brow Artist Designer Pro 3-in-1	<ol style="list-style-type: none"> 1. Dual pencil & powder texture
		Brow Artist Genius Kit	<ol style="list-style-type: none"> 1. Powder texture 2. Provided with brow wax
7	Eyeshadow	Shimmer Liquid Eye Shadow	<ol style="list-style-type: none"> 1. 16 hours longevity 2. Liquid texture 3. Shimmer finish
8	Lipstick	Infallible Pro-Matte Liquid	<ol style="list-style-type: none"> 1. 16 hours longevity 2. Matte finish
		Infallible Pro-Matte Gloss	<ol style="list-style-type: none"> 1. Natural glossy texture 2. Velvet matte finish

The knowledge captured for each product category that only has one product selection (e.g. blush and eyeshadow) was only considering about the suitability of colors in each skin tone. After all the knowledge were obtained, the translation of the knowledge was done to build the old cases for case-based reasoning. The knowledge translation was done to precisely decide the score for each make-up look with various product combinations from the users. It was suited with the explicit knowledge obtained from the official product description. Table 4.3 shows the process of translating the knowledge obtained from the expert. There are columns for user input, referred knowledge, the result of knowledge from the expert, the expert, and the product recommendation. Table 4.3 shows the example for user with natural make-up preference, dry skin condition, and light skin tone. The most suitable foundation that should be chosen in order to get high score based on the selected input is True Match Cushion Foundation, considering the knowledge from the expert. When user chose Infallible 24H Liquid Fresh Foundation or True Match Liquid Foundation, the score generated is normal. Lastly, the user will get low score if the user chose Infallible Pro-Matte Foundation.

Table 4.3 The Example of Knowledge Translation

No	User Input	Knowledge	Expert Knowledge	Expert	Product Recommendation
1	1.) Natural make-up 2.) Dry skin condition 3.) Light skin tone	K1.1	Foundation needs to be sheer to medium coverage	Molita Lin	1.) True Match Cushion Foundation (HIGH) 2.) Infallible 24H Liquid Fresh Foundation (NORMAL) 3.) True Match Liquid Foundation (NORMAL) 4.) NO FOUNDATION (NORMAL) 5.) Infallible Pro-Matte Foundation (LOW)
			Cushion foundation is suitable for natural make-up	Molita Lin	
			No foundation is acceptable for natural make-up	Devienna	
			High coverage foundation is not suitable for natural make-up	Devienna	
			Foundation with thick formula and high coverage is not suitable for natural make-up	Nedita Farah	

4.2.3 Case Drafting for Standardization of Scoring System

This step was done after all the knowledge were obtained. This aimed to set the standard of the scoring system by drafting the old cases that soon to be retrieved in case-based reasoning cycle. This is also the realization of externalization (conversion of tacit knowledge to explicit knowledge) and combination (conversion of explicit knowledge to explicit knowledge) from knowledge management SECI model. There are 54 old cases drafted in total, ranging from the case for highest, middle, and lowest score in each make-up style, skin condition, and skin tone. Table 4.4 shows the example of old case for highest score in Bold make-up style, considering normal skin condition and light skin tone as the input from the users. The remaining 53 old cases can be seen in Attachment.

Table 4.4 Example of Old Case for High Score in Bold Make-up Style

CASE 1			
Objective	Building a HIGH score for heavy make-up style		
Descripti on	This case is drafted for make-up look that gets HIGH score in bold make-up style considering normal skin condition & light skin tone		
Obtained data	Normal skin type		
	Light skin tone		
Solution	Product	Name	Shade
	Foundati on	Infallible Pro-Matte 24H Foundation	101 Classic Ivory 102 Shell Beige
		Infallible 24H Liquid Fresh Foundation	020 Ivory 130 True Beige
		True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla
	Blush		Le Bar a Blush	01 More Than Enough 10 Play

CASE 1			
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 435 Crystal Shine 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
	Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist 358 Cowboy 362 Plum Bum 366 Stirred 370 Roseblood
Infallible Pro-Matte Gloss		301 Blushing Ambition 318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss 314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia	

CASE 1			
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
		Brow Artist Genius Kit	Light to Medium Medium to Dark

4.3 Case-based Reasoning

Case-based reasoning is an approach used for generating the scoring system by utilizing knowledge from beauty experts. 54 old cases are ready to be retrieved in the system. Those old cases consist of case for highest, middle, and lowest score scenario for each skin tone and skin condition. Case-based reasoning cycle starts with retrieving the most similar case and set the closest value as the solution to the new case. User will input the combination of the products to be scored and the case-based reasoning system will give automate feedback of the score ranges from High, Normal, and Low. From the old cases drafted in previous step, the solution will be looked based on the most relevant case according to the closest similarity. The formula to calculate the similarity is seen on Equation (4.1).

$$Similarity (problem, case) = \frac{1}{\sum_{i=1}^n w_i} \sum w_i \times s_i \quad (4.1)$$

Where;

w_i = Weight of the feature

s_i = Similarity value

The weight in this formula indicates the importance of each index in the case. The weight for index can be 1 or 6. 1 indicates less important index while 6 indicates very important index. In this research, the indexes and each weight used for the scoring system are:

- Make-up style = 6
- Skin condition = 1
- Blush = 1
- Eyeshadow = 1

- Skin tone = 6
- Foundation = 6
- Eyebrow = 1
- Lipstick = 6

The similarity between two cases can be calculated after the weight has been decided. Table 4.5 shows the example of user input of the product combinations that is implied as new case in case-based reasoning scenario.

Table 4.5 Example of New Case

EXAMPLE OF NEW CASE	
Make-up Style	Moderate
Skin condition	Dry
Skin tone	Medium
Foundation	True Match Liquid Foundation / N4 Nude Beige
Blush	Le Bar a Blush / 01 More Than Enough
Eyeshadow	(X) NO EYESHADOW
Eyebrow	Brow Artist Designer Pro 3-in-1 / Dark Brown
Lipstick	Infallible Pro-Matte Liquid Lipstick / 362 Plum Bum

The similarity test should be conducted with old cases that have been drafted to find the solution and suitable score for this new case. However, not all of the old cases need to be calculated with the new case. The old cases should be sorted based on the similar make-up style, skin condition, and skin tone. It can be seen from the example of new case that the make-up style is moderate, the skin condition is dry, and the skin tone is medium. Thus, the old cases that will be calculated alongside with new cases are the cases that have similar indexes on said part.

There are 3 old cases among 54 old cases that match the indexes and can proceed to the similarity test with new case. Consider that the new case is marked with NC and the old cases are marked with C31, C32, and C33. The example of similarity test can be seen in Table 4.6 where indexes from both cases are being matched. For example, the foundation index in new case is True Match Liquid Foundation. Meanwhile, the foundation selection that is on the index of the old case are Infallible 24H Liquid Fresh Foundation and True Match Cushion Foundation. So, the foundation index in new case does not comply the index of the old case and the value is 0. Another example, the lipstick index in new case is Infallible Pro-Matte Liquid Lipstick in the shade 362 Plum Bum. The same lipstick is listed on lipstick index of the old case. Thus, the value is marked by 1.

Table 4.6 Example of New Case and Case 31 – High Score Similarity Test

EXAMPLE OF NEW CASE			CASE 31 - HIGH SCORE		
Make-up Style	Moderate	→	1	Make-up Style	Moderate
Skin condition	Dry	→	1	Obtained Data Skin condition	Dry
Skin tone	Medium	→	1	Skin tone	Medium
Foundation	True Match Liquid Foundation / N4 Nude Beige	→	0	Foundation	1) Infallible 24H Liquid Fresh Foundation 2) True Match Cushion Foundation SHADE 1) 125 Natural Rose / 200 Golden Sand / 220 Sand 2) G1 Gold Ivory
Blush	Le Bar a Blush / 01 More Than Enough	→	0	Blush	1) Le Bar a Blush SHADE 1) 03 I Have A Dream / 10 Play With Me
Eyeshadow	X NO EYESHADOW	→	0	Eyeshadow	1) Shimmer Liquid Eye Shadow SHADE 1) 415 Diamond Drop / 440 Amber Sparkle / 430 Blush Jewel / 455 Bronze Light / 435 Crystal Shine / 450

EXAMPLE OF NEW CASE	
Eyebrow	Brow Artist Designer Pro 3-in-1 / Dark Brown
Lipstick	Infallible Pro-Matte Liquid Lipstick / 362 Plum Bum

→ 1

→ 1

CASE 31 - HIGH SCORE		
		Precious Lava / 460 Radiant Ruby / 420 Rose Gem / 465 Royal Onyx
Eyebrow	1) Brow Artist Designer Pro 3-in-1 2) Brow Artist Genius Kit	SHADE 1) Light Brown / Dark Brown / Grey Atelier 2) Light to Medium / Medium to Dark
Lipstick	1) Infallible Pro-Matte Liquid Lipstick 2) Infallible Pro-Matte Gloss	SHADE 1) 372 Petal Potion / 354 Nudist / 358 Cowboy / 362 Plum Bum / 366 Stirred / 370 Roseblood 2) 318 Barre Attraction / 316 Statement Nude / 304 Rebel Rose / 310 Forbidden Kiss / 314 Nude Allude /

EXAMPLE OF NEW CASE	

CASE 31 - HIGH SCORE		
		312 Rouge Envy / 302
		Fuchsia Amnesia

Where:

—————→ = Very important index

—————→ = Less important index

There are 4 very important indexes and 4 less important indexes. So, the sum of the weight is 28. The calculation of this similarity test is given as follows.

$$\text{Similarity}(NC, C31) = \frac{1}{28} [(6 \times 1) + (1 \times 1) + (6 \times 1) + (6 \times 0) + (1 \times 0) + (1 \times 0) + (1 \times 1) + (6 \times 1)]$$

$$\text{Similarity}(NC, C31) = \mathbf{0.71}$$

The similarity level between new case and case 31 is 0.71. The calculation of similarity continues for C32 in Table 4.7.

Table 4.7 Example of New Case and Case 31 – Normal Score Similarity Test

EXAMPLE OF NEW CASE			CASE 32 – NORMAL SCORE		
Make-up Style	Moderate	→	1	Make-up Style	Moderate
Skin condition	Dry	→	1	Obtained Data Skin condition	Dry
Skin tone	Medium	→	1	Skin tone	Medium
Foundation	True Match Liquid Foundation / N4 Nude Beige	→	1	Foundation 1) True Match Liquid Foundation 2) Infallible 24H Liquid Fresh Foundation 3) True Match Cushion Foundation	SHADE 1) G1 Gold Ivory, G2 Gold Porcelain, N3 Nude Vanilla, G3 Gold Vanilla, N4 Nude Beige , G4 Gold Beige, G5 Gold Cream, N7 Nude Ambre 2) 02 Ivory, 130 True Beige, 140 Golden Beige, 150 Radiant Beige, 250 Radiant Sand 3) N1 Nude Ivory, G3 Gold Vanilla

EXAMPLE OF NEW CASE	
Blush	Le Bar a Blush / 01 More Than Enough
Eyeshadow	(X) NO EYESHADOW
Eyebrow	Brow Artist Designer Pro 3- in-1 / Dark Brown
Lipstick	Infallible Pro- Matte Liquid Lipstick / 362 Plum Bum

→ 1

→ 1

→ 1

→ 1

CASE 32 – NORMAL SCORE		
Blush	1) Le Bar a Blush 2) (X) NO BLUSH	SHADE 1) 01 More Than Enough / 11 Be Fearless
Eyeshadow	1) Shimmer Liquid Eye Shadow 2) (X) NO EYESHADOW	SHADE 1) 425 Amethyst Quartz, 445 Crown Gold
Eyebrow	All Products	
Lipstick	All products	

$$\text{Similarity}(NC, C32) = \frac{1}{28} [(6 \times 1) + (1 \times 1) + (6 \times 1) + (6 \times 1) + (1 \times 1) + (1 \times 1) + (1 \times 1) + (6 \times 1)]$$

$$\text{Similarity}(NC, C31) = 1.00$$

The similarity level between new case and case 32 is 1.00. Lastly, the calculation of similarity for new case and case 33 can be seen in Table 4.8.

Table 4.8 Example of New Case and Case 31 – Low Score Similarity Test

EXAMPLE OF NEW CASE			CASE 32 – LOW SCORE			
Make-up Style	Moderate	→	1	Obtained Data	Make-up Style	Moderate
Skin condition	Dry	→	1		Skin condition	Dry
Skin tone	Medium	→	1		Skin tone	Medium
Foundation	True Match Liquid Foundation / N4 Nude Beige	→	0	Foundation	1) Infallible Pro-Matte 24H Foundation 2) (X) NO FOUNDATION	SHADE 1) 101 Classic Ivory, 102 Shell Beige, 104 Golden Beige, 105 Natural Beige, 106 Sun Beige, 107 Fresh Beige, 110 Crème Café

EXAMPLE OF NEW CASE	
Blush	Le Bar a Blush / 01 More Than Enough
Eyeshadow	(X) NO EYESHADOW
Eyebrow	Brow Artist Designer Pro 3- in-1 / Dark Brown
Lipstick	Infallible Pro- Matte Liquid Lipstick / 362 Plum Bum

→ 0

→ 0

→ 0

→ 0

CASE 32 – LOW SCORE		
Blush	All Products	
Eyeshadow	1) Shimmer Liquid Eye Shadow	SHADE 1) 410 String of Pearls
Eyebrow	1) (X) NO EYEBROW	
Lipstick	1) Infallible Pro-Matte Gloss 2) (X) NO LIPSTICK	SHADE 1) 301 Blushing Ambition

Similarity (NC, C32)

$$= \frac{1}{28} [(6 \times 1) + (1 \times 1) + (6 \times 1) + (6 \times 0) + (1 \times 0) + (1 \times 0) + (1 \times 0) + (6 \times 0)]$$

$$\text{Similarity (NC, C31)} = 0.46$$

The similarity level between new case and case 32 is 0.46. Thus, all of the similarity levels for the new case and its most relevant old cases are already obtained. The comparison between all of the similarity levels should be done next to see which old case has the biggest value of similarity level. The case with the biggest similarity level becomes the solution of the new case and is ready to be reused.

Error! Not a valid bookmark self-reference. shows the recapitulation of similarity level.

Table 4.9 Recapitulation of Similarity level for New Case

RECAPITULATION OF SIMILARITY LEVEL	
Similarity (NC, C31)	0.71
Similarity (NC, C32)	1.00
Similarity (NC, C33)	0.46

It can be seen from the recapitulation that the closest similarity is held between New Case and Case 32. Case 32 indicates normal score for the make-up style, skin condition, and skin tone selected by user. Therefore, the score for the combinations of products constructed by user in new case is Normal.

4.4 Usability Testing of Current Try On Feature

The usability testing step in this research is intended to evaluate the current Try On feature on L’Oreal Paris Indonesia website as the benchmark product of the proposed Virtual Beauty Advisor. The result from usability testing can be used as a recommendation on designing the Virtual Beauty Advisor. Due to the limitation

of the situation, the usability testing was conducted via virtual meeting with participants.

4.4.1 Participants Profile

The participants used for this research were all women ranges from age 21 to 23 and the majority of them are college students. The consideration of the demographic criteria for participants is caused by the likeliness of participants to be the targeted audience for beauty influencers in social media. Women from the said age range are also more likely to keep up with the beauty trends and more adapt to technology. From 2nd July 2020 to 19th July 2020, there were 20 participants involved in this research, and 100% of them were unfamiliar with current Virtual Try-On.

4.4.2 Task and Scenario

The participants of usability testing were asked to create a desired make-up look using the combination of products displayed on L'Oreal Paris Virtual Try-On. To create the final look, participants were obliged to try the foundation, eyebrow, lipstick, mascara, and concealer. The scenario was given to the participants to visualize the situation where they can use the Try-On feature. The scenario was to imagine that they had upcoming events that require them to wear make or they were simply just running out of cosmetic products. Meanwhile, they were busy with their schedule (work/study) so they were unable to go to the offline store to do direct shopping. Online shopping was the solution that could be used, but they were afraid that the products did not suit them well because they were unable to try the products directly. They wanted to make sure that the products suit them by virtually try the products through Virtual Try-On feature. Figure 4.4 shows the example of a participant trying the foundation feature of Virtual Try-On.

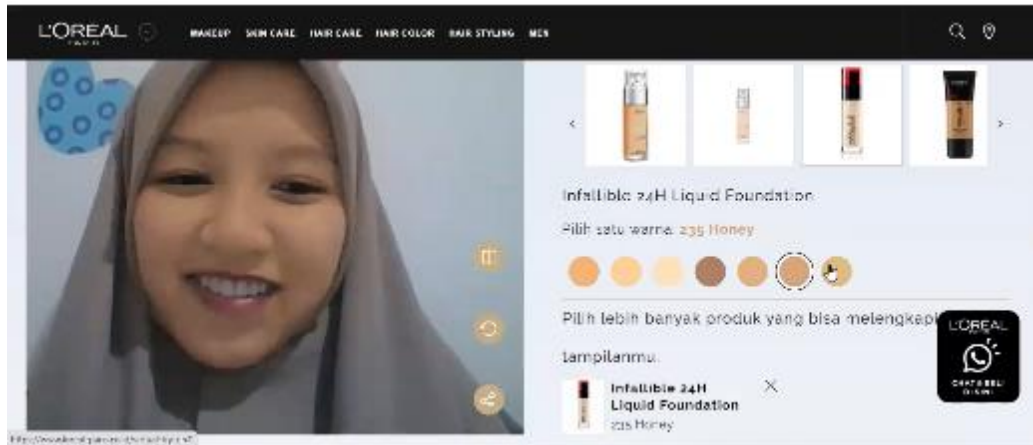


Figure 4.4 The Example of Participant Trying Foundation Feature

The participants did not have limitations on time and the creation of the makeup look that they wanted to make. They were free to choose which products that they wanted to try although they had to try each product category.

4.4.3 Standardized Usability Questionnaire

This step was done after the participants completed all of the tasks and scenarios in usability testing. This research uses PSSUQ as the standardized usability questionnaire that is aimed to measure the satisfaction of the users on doing or trying the Virtual Try-On feature. The questionnaire given to the participants was being modified into Indonesian language to ensure better understanding and to avoid any missed information. Figure 4.8 shows the recapitulation of PSSUQ result. It recaps the number of participants that rate each statement on each scale. SA indicates Strongly Agree while SD indicates Strongly Disagree.

Table 4.10 Tabulation of PSSUQ Result

No	Statements	SA	1	2	3	4	5	6	7	SD	Average
1	Overall, I am satisfied with how easy it is to use this system.		1	7	7	2	3	0	0		2.95
2	It was simple to use this system.		3	11	5	1	0	0	0		2.2
3	I was able to complete the tasks and scenarios quickly using this system.		3	8	6	0	2	1	0		2.65
4	I felt comfortable using this system.		3	4	7	2	4	0	0		3
5	It was easy to learn to use this system.		8	5	5	1	0	1	0		2.15
6	I believe I could become productive quickly using this system.		3	5	6	4	2	0	0		2.85
7	The system gave error messages that clearly told me how to fix problems.		1	2	8	1	4	4	0		3.85
8	Whenever I made a mistake using the system, I could recover easily and quickly.		5	4	5	2	2	1	1		2.95
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.		3	8	4	0	4	1	0		2.85
10	It was easy to find the information I needed.		3	8	3	3	2	1	0		2.8
11	The information was effective in helping me complete the tasks and scenarios.		3	10	3	2	2	0	0		2.5

No	Statements	SA	1	2	3	4	5	6	7	SD	Average
12	The organization of information on the system screens was clear.		3	7	5	1	4	0	0		2.8
13	The interface of this system was pleasant.		5	4	7	4	0	0	0		2.5
14	I liked using the interface of this system.		5	4	7	4	0	0	0		2.5
15	This system has all the functions and capabilities I expect it to have.		4	3	4	6	2	1	0		3.1
16	Overall, I am satisfied with this system.		3	6	5	4	2	0	0		2.8

4.4.4 Think Aloud

Think aloud is one of the protocols used in the testing that aims to collect the problems faced by users. Participants were free to express all of their feelings toward Virtual Try-On feature. The behavior and actions taken by the participants can be recorded through think aloud. Participants were often giving recommendations toward the problems based on their subjectivity. The majority of problems faced by participants were listed in Table 4.11.

Table 4.11 Think Aloud Recapitulation

No	Problems
1	The notification of invalid product is disturbing for users
2	What the system meant by invalid product is unclear to users
3	Users cannot differentiate the result from one mascara product to another
4	Users cannot see the result of concealer feature
5	Users cannot see the description and the differences between one product and another
6	Try-On feature cannot cover the information about product's texture that determines the suitability of the product in various skin condition
7	Users are dissatisfied with the display of their faces that are too up close and not fit in one screen
8	Users are confused on how to remove the product that is already selected
9	The product category selection is too limited; there is no blush and eyeshadow
10	The color payoff on the face with the color displayed on the selection is different for some products
11	The toolbar of the website is disturbing

4.4.5 Open Questionnaire

Open questionnaire was given to the participant of the usability testing to capture the things that are not covered in PSSUQ. Some questions were asked to dig the difficulty of the participants while also asking for the recommendations that can be given for the improvement. The following is the recapitulation of participants' responses to each question.

1. How is participant's overall impression of the Virtual Try-On feature?

Positive Comments:

- Most participants feel that this feature is interesting and fun to use
- Most participants feel that this feature helps them to decide the product that is right for them without going to the store
- Participants feel that this feature is easy to use and beginner-friendly
- Most participants feel that this feature will minimize the likeliness of purchasing the wrong products because they can try the products before buying
- Participants feel that this feature is creative

Negative Comments:

- Participants feel that this feature is not comfortable enough to be used
- The color payoff of each product is not clear enough and different with the display
- The interface of this feature (from the fonts used and the placement of the images) is not clear
- The absence of product description makes the participants confused about the difference between one product and another
- Participants find it hard to understand the information delivered through this feature

2. What is the best thing from the Virtual Try-On feature?

Participants were asked to think of the best thing or the most favorite thing that they found during the use of Virtual Try-On feature.

- The ability to create a full make-up look using various product categories (foundation, lipstick, eyebrow, etc.)
- The ability to try the products virtually without needing to go to the offline stores
- This feature provides a smoother experience of shopping for beauty products

3. What is the worst thing from the Virtual Try-On feature?

Participants were also asked to think of the worst thing they found on Virtual Try-On feature, as opposed to the previous question.

- The limitation of augmented reality technology makes the gap between the real color of the products and the color displayed on the feature, so the participants are unsure whether or not the color suits them
- There is no explanation about the products. Information regarding the finish, texture, and coverage cannot be covered by this feature
- Not all of the displayed products are available to be tried
- The concealer and mascara features do not help

4. Does participant feel that Virtual Try-On feature helps in deciding which product is suitable?

This question can be answered only with Yes or No. This question aims to see whether current Virtual Try-On feature already answers the confusion of the users on deciding which product is suitable. Figure 4.5 shows the visualization of the answers.

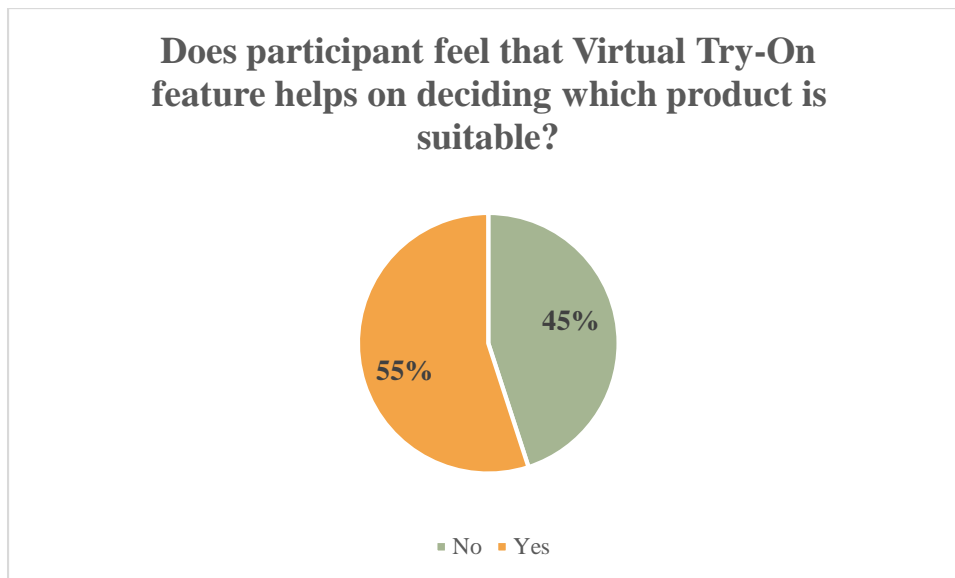


Figure 4.5 Answer Result from Question no. 4

5. What is the reason on answering Yes/No to the previous question?

From the answer result in Question no. 4, there is only a slight difference between the amount of participants who chose Yes or No. In this question, the participants were asked about the reason of choosing Yes or No.

Yes:

- Because the feature allows the participants to see each color applied on the face
- Because the feature allows the participants do the creation of the make-up look with the combinations of the product
- Because the participants can automatically determine which color is not suitable for them

No:

- Because the participants are still unable to know the suitability of the products with their skin condition
- The information regarding texture, formula, and finish are not covered by the feature
- The color displayed by the feature does not represent the actual color of the products

6. What are the recommendations that the participant can give to improve the Virtual Try-On feature?

Below is the list of recommendations given by the participants to improve the Virtual Try-On feature.

- The button to remove the product that is already used should be made close to the product selection (can be using the double-click to remove the selected products or providing a ‘no shade’ selection)
- The products that cannot be tried (invalid products) do not need to be displayed
- Users should be allowed to see the description or information regarding the products (texture, finish, and other characteristics)
- The product category should be increased with the addition of blush and eyeshadow
- Users should be allowed to choose make-up preferences to curate the products that suit them

4.5 Designing Virtual Beauty Advisor

This subchapter presents the design of Virtual Beauty Advisor and the user scenario that aims to explain the user flow of this feature. Virtual Beauty Advisor feature in this research is specifically meant for women whose age ranges between 21 to 23, considering the user persona gained from previous step.

4.5.1 User Interface Design

This subchapter presents the interface design of Virtual Beauty Advisor. The design of Virtual Beauty Advisor was developed after collecting the result of current Virtual Try-On evaluation. The design was developed using Adobe XD software. The improvement for Virtual Beauty Advisor was focusing on the Virtual Try-On feature. This also points out the improvement made based on the problems and recommendations from the participants of usability testing. The first page is the landing page that consists of the brief explanation about the Virtual Beauty Advisor. The ‘start now’ button is created to start the process.

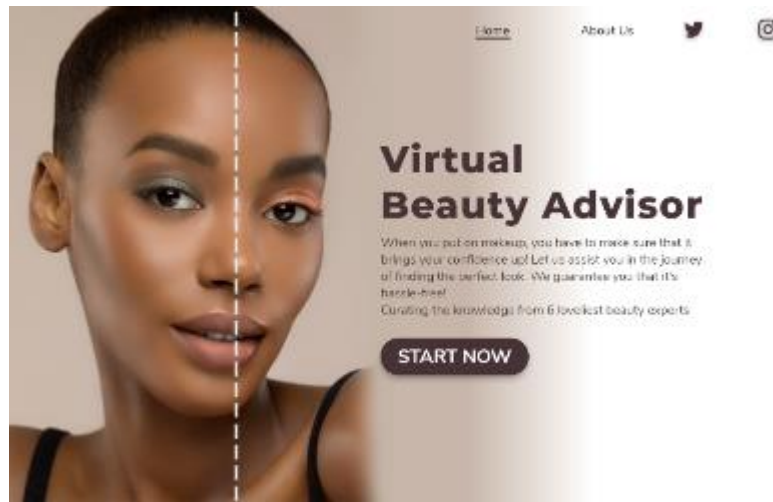


Figure 4.6 Landing Page of Virtual Beauty Advisor

The main integral parts of the Virtual Beauty Advisor design are the user input mentioned in Table 3.3 that users select in order to generate the tailored score for selected make-up style, skin condition, and skin tone. The options to choose make-up style is shown immediately after the user clicks “Start Now” from the landing page.

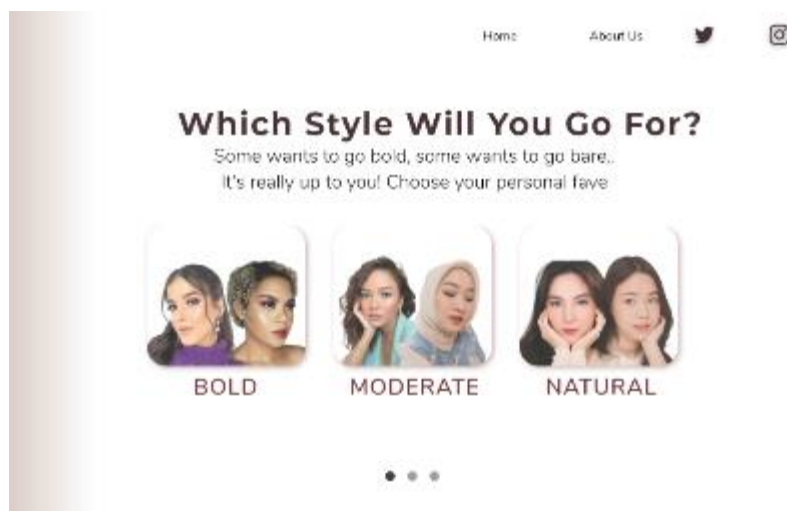


Figure 4.7 Make-up Style Selection

The next is the options to choose skin condition. This is meant for adjusting the suitable products based on the skin concerns. Figure 4.8 shows the display of skin condition selection.

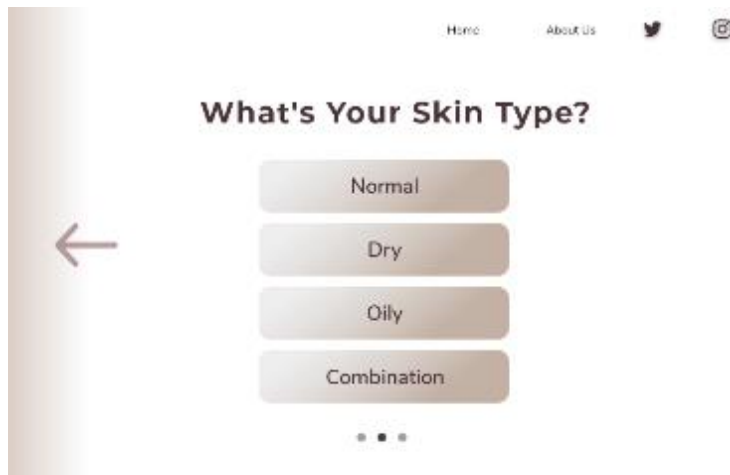


Figure 4.8 Skin Condition Selection

The final step for user input is selecting the skin tone. This is meant for adjusting the color selections of the product based on skin tone.

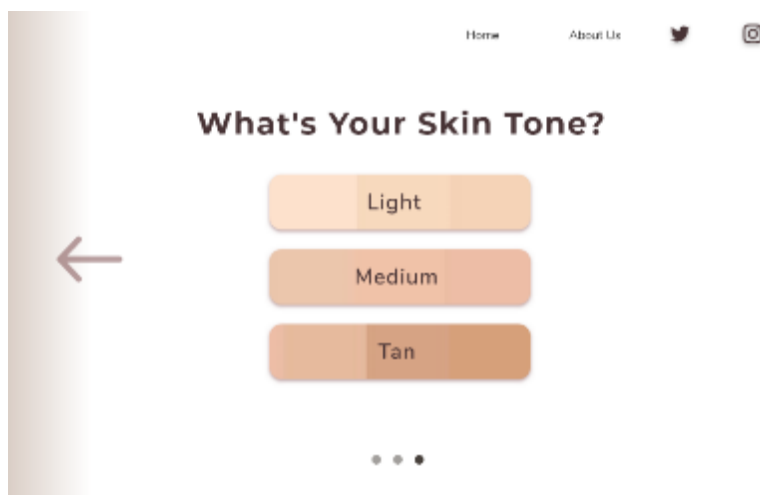


Figure 4.9 Skin Tone Selection

Then, the user can immediately go to the Virtual Try-On display where user can turn on the web camera and select the products. User needs to validate the consent of displaying the face to the web camera before using the feature by checking the 'I Consent' box seen on Figure 4.10. The web camera is ready to be used afterwards.

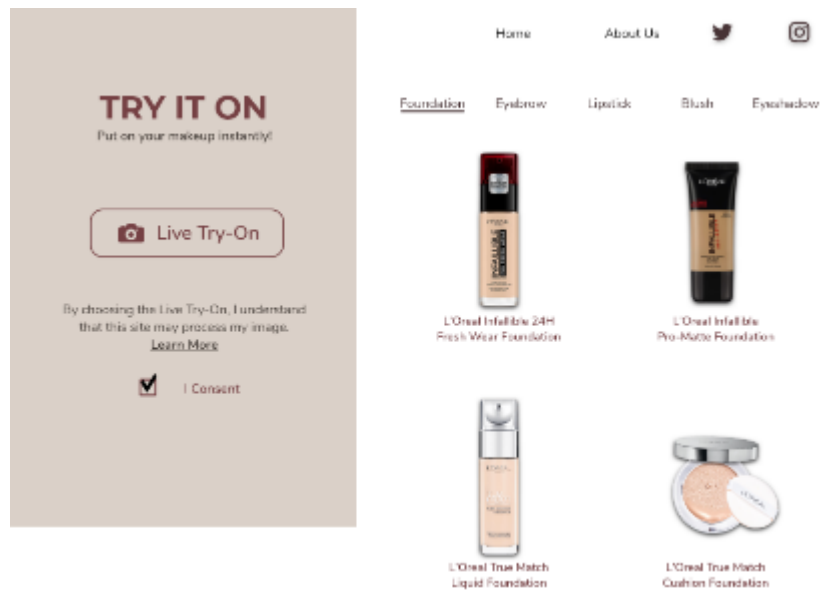


Figure 4.10 User Consent

The Live Try-On button seen on Figure 4.10 needs to be clicked to show the face of the user. The make-up categories that can be tried are foundation, eyebrow, lipstick, blush, and eyeshadow. The selection of products appears when the category is clicked. Figure 4.11 shows the display of the feature when the user virtually tries the foundation. The information that are displayed when the user clicks on particular product are the rating, description, ingredients, and shade selections. There is also an “I’M DONE” button that can be clicked when the user is done creating the make-up look. Figure 4.11 portrays the user when selecting a particular shade of foundation. The information about the selected shade is written next to ‘Choose your shade:’ statement. User can choose to undo the selected product by choosing a ‘none’ button that is placed on the right side of shade selection.

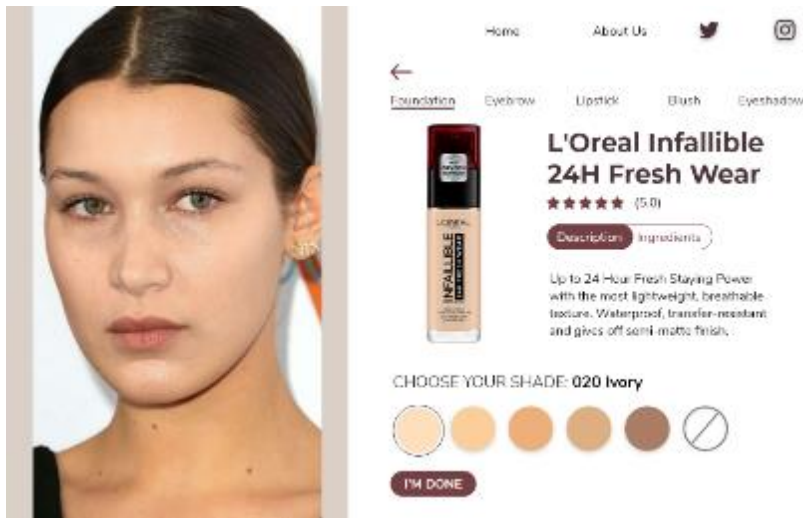


Figure 4.11 Example of Foundation Feature Usage

The “I’M DONE” button can be clicked when the user has already selected some products. If the user wishes to cancel the product, the ‘none’ button on the right side of the shade selection is clicked and the information about the selected shade is written as ‘no shade selected’ as seen on Figure 4.12. The “I’M DONE” button disappears when the user does not select any product.

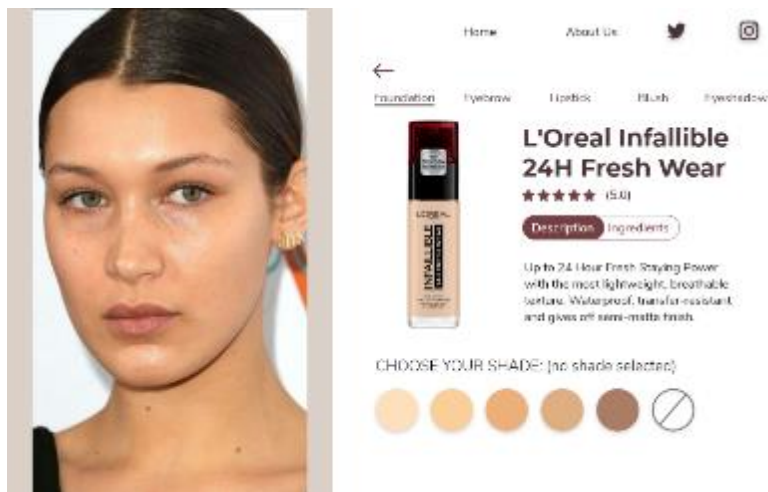


Figure 4.12 Example of Foundation Feature Usage (2)

User can choose to select other make-up category feature, such as eyebrow, lipstick, blush, and eyeshadow. Figure 4.13 shows the example of user trying eyeshadow feature.

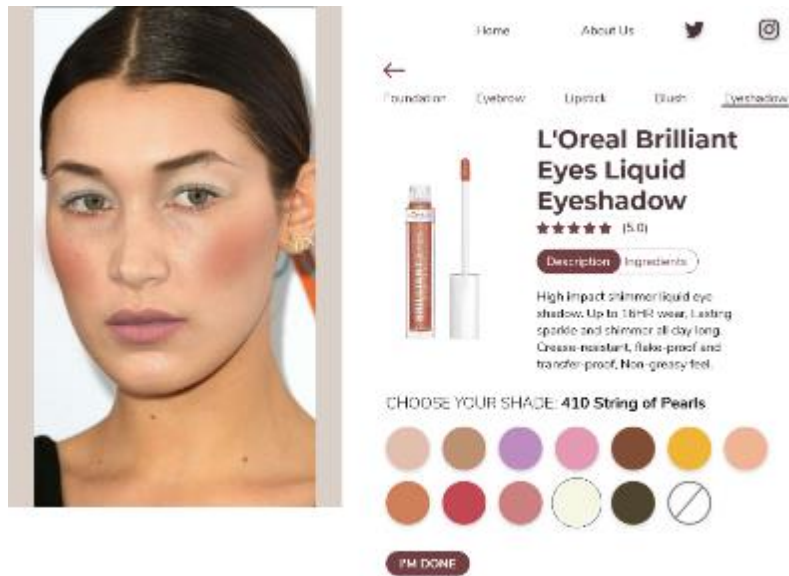


Figure 4.13 Example of Eyeshadow Feature Usage

User can choose to see whether the description of the product or the ingredients contained in the product. The ingredient information will appear when the user swipes the button to the right. Figure 4.14 shows the display of ingredients information.

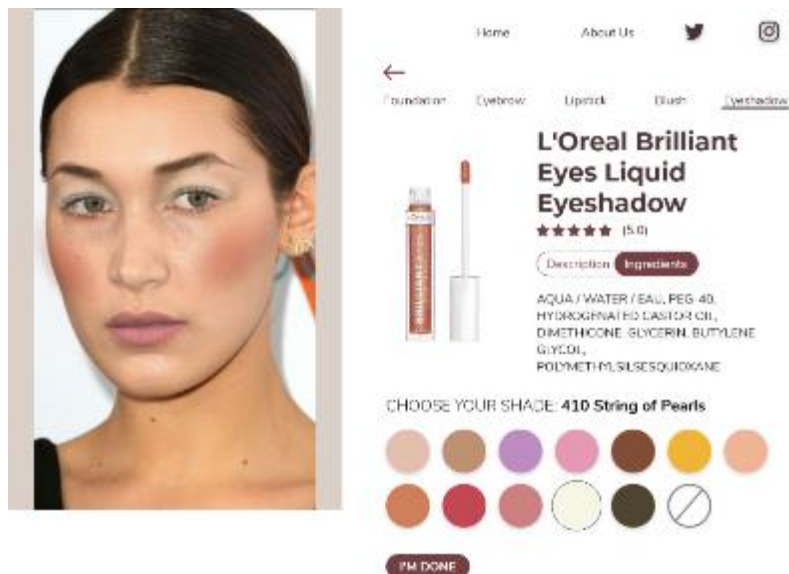


Figure 4.14 Example of Eyeshadow Feature Usage (2)

The final step and also the main idea of the Virtual Beauty Advisor is the scoring system that can be generated when the user has completed the make-up look. The user input (selected make-up style, selected skin condition, and selected skin tone) and the products selected by the user are encountered as ‘new case’ in case-based reasoning. The system looks up the ‘old cases’ obtained from experts’ knowledge to retrieve the most similar case as the final score of the user’s constructed make-up look. In this example, the new case has the most similarity value with the old case that portrays the low score of moderate make-up style with normal skin condition and medium skin tone. Figure 4.15 shows the example of the final score display when the user gets a low score. It is generated by clicking the “I’M DONE” button seen on previous pictures. It is completed with the explanation about the look and the product recommendations to improve the make-up look.

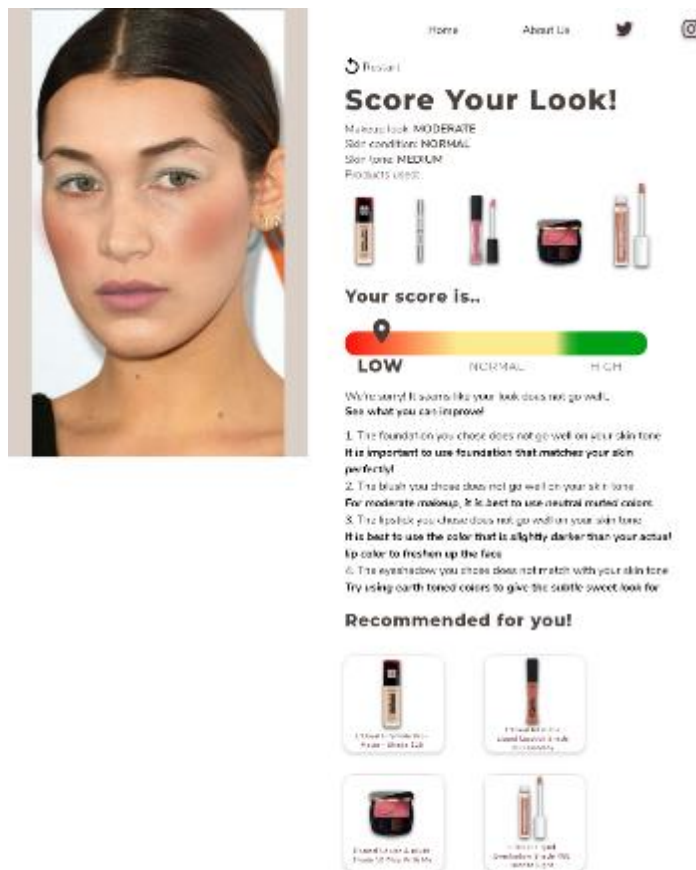


Figure 4.15 The Final Score - Low

The user can re-start the process by clicking the “restart” button. The restart button can be used for the same user with the same user input, because the display will be back to Figure 4.11 when the button is clicked. The user can click the ‘Home’ button to try again for different user input. The display will be back to Figure 4.6 when the home button is clicked.

There are other scenarios where user obtained normal or high score. Figure 4.16 shows the visualization of normal score. User also gets the recommendation of products that can be used to make the final look better.



Figure 4.16 The Final Score - Normal

Figure 4.17 shows the visualization of high score obtained by user. User does not get the product recommendations because the final look is already perfect according to the scoring system.

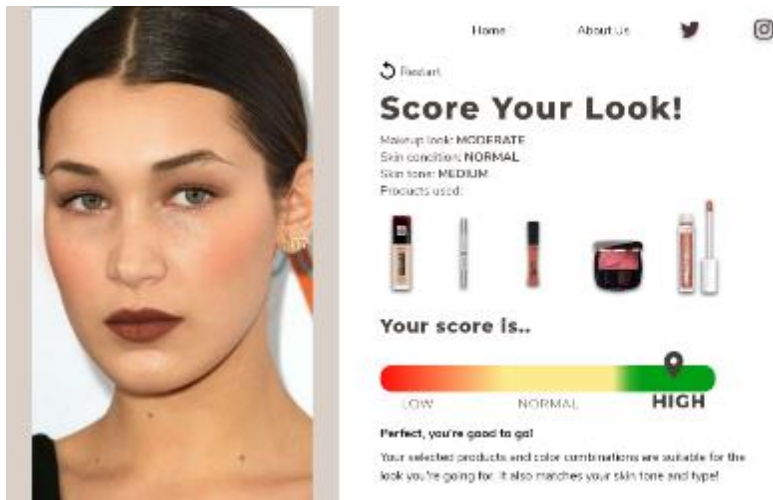


Figure 4.17 The Final Score - High

This research needed to validate the proposed idea to the participants of usability testing to know whether the improvement had brought the improvement that could satisfy the users better than the current Virtual Try-On feature. So, the participants of usability testing were given another questionnaire to score the improvement on Virtual Beauty Advisor. The questions given in the questionnaire were to rank the features seen in Figure 4.7, Figure 4.8, Figure 4.9, Figure 4.11, and Figure 4.15 on a scale 1 (Strongly Dissatisfied) to 5 (Strongly Satisfied). Figure 4.18 shows the example of question given in the second questionnaire.

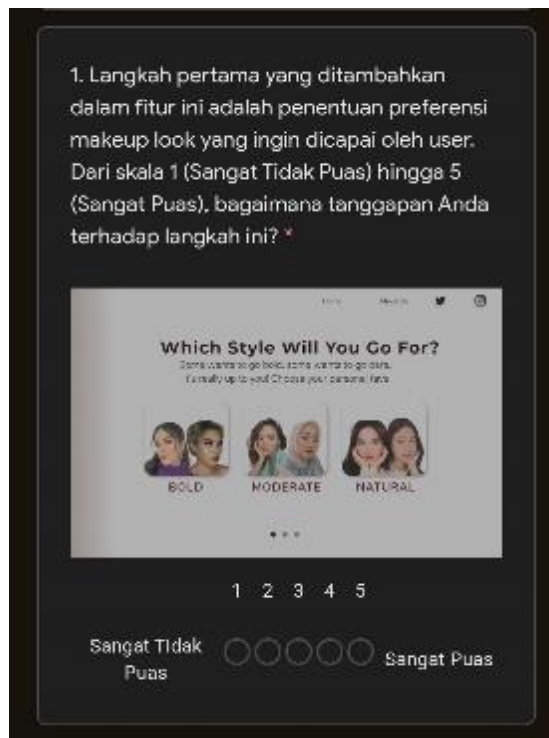


Figure 4.18 The Example of Question in Second Questionnaire

The result of the ranking for make-up selection feature can be seen on Figure 4.19.

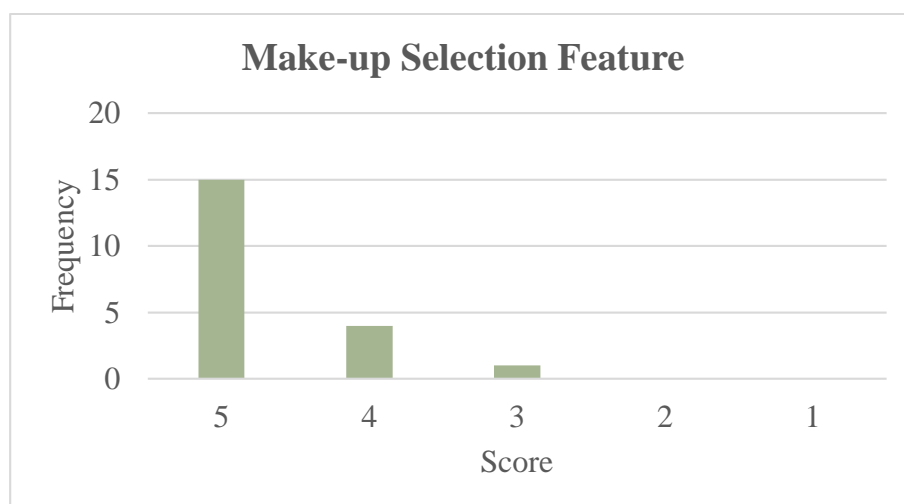


Figure 4.19 The Result of Make-Up Selection Feature Ranking

Then, the participants ranked the skin condition selection feature. The result of the ranking is shown in Figure 4.20.

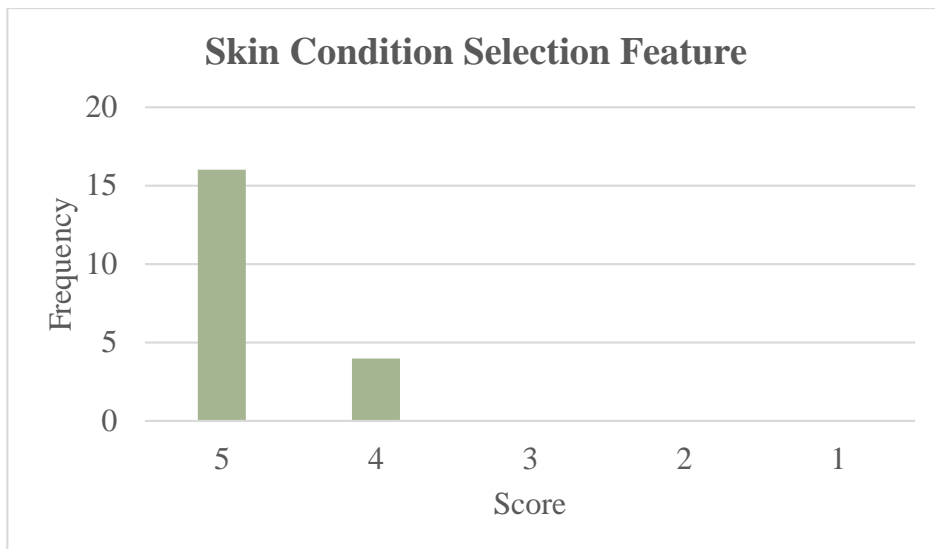


Figure 4.20 The Result of Skin Condition Selection Ranking

The participants also ranked the skin condition selection feature. The result of the ranking is shown in Figure 4.21.

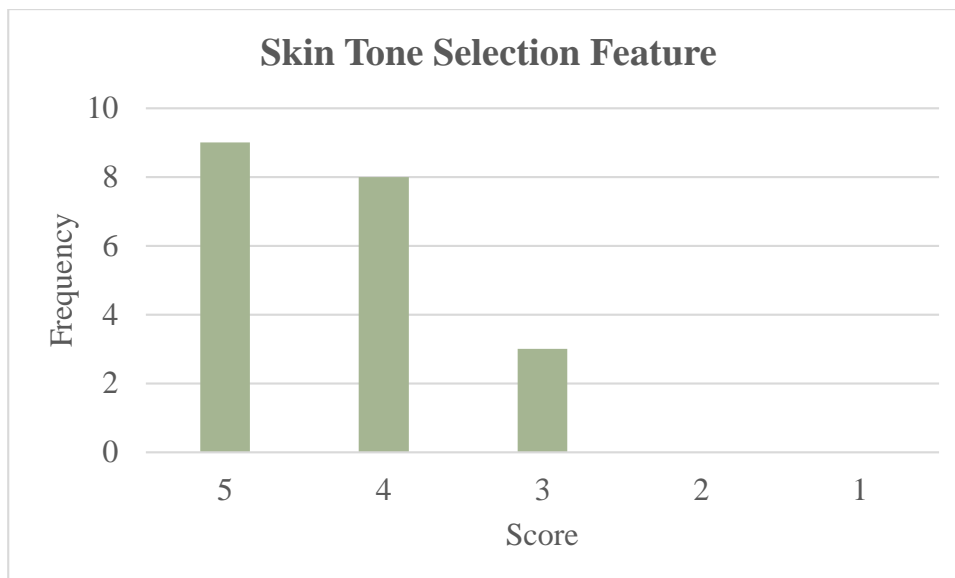


Figure 4.21 The Result of Skin Tone Selection Ranking

The button used to generate the score when the user completes the make-up look was also ranked by the participants. Figure 4.22 shows the result of the ranking.

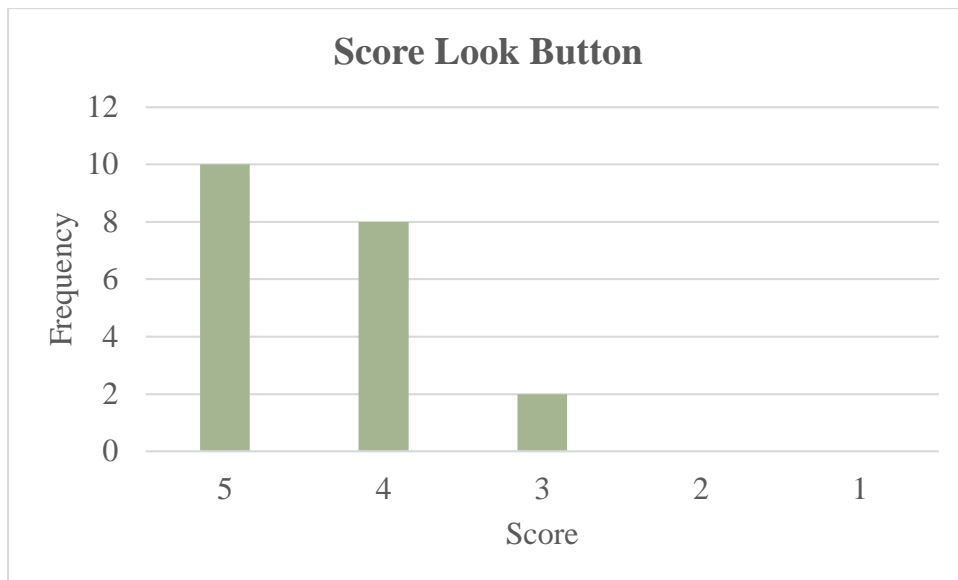


Figure 4.22 The Result of Score Look Button Ranking

Lastly, the display of the score generated by the system was also ranked by the participants. Figure 4.23 shows the result of the ranking.

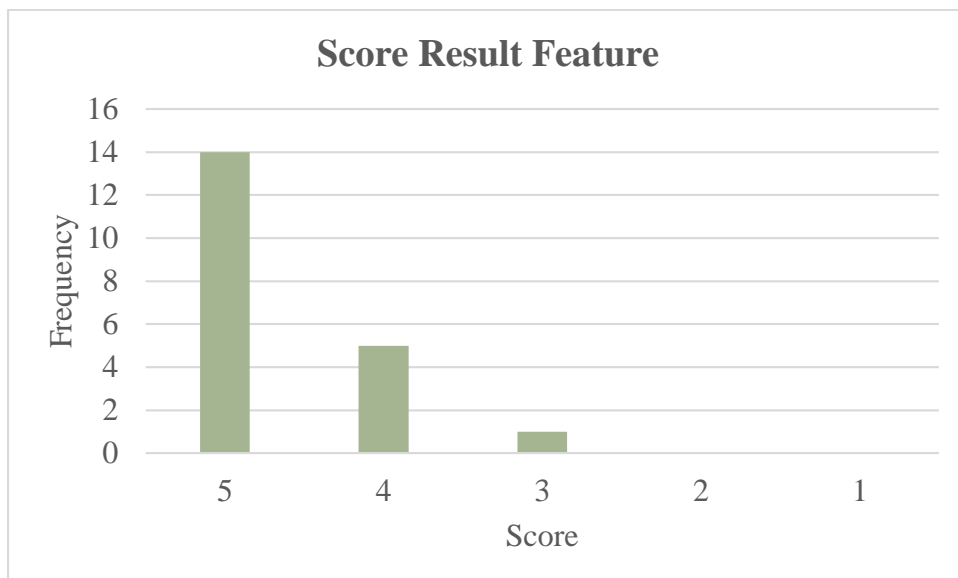


Figure 4.23 The Result of Score Generating Result Ranking

All of the proposed improvements for Virtual Beauty Advisor have been ranked by the participants. The participants were also obliged to fill the open questionnaire. Below is the recapitulation of participants' answers from the open questionnaire.

1. How is participant's overall impression of the Virtual Beauty Advisor?

- Most participants feel that this feature is better than the current Virtual Try-On feature.
- Most participants feel that this feature could help them better in deciding which product is suitable for them because of the personalized result for different preferences, skin conditions, and skin tone.
- Participants feel that this feature will help the users that are still unfamiliar and new with make-up.
- Most participants feel that this feature will minimize the likeliness of purchasing the wrong products because they can try the products before buying.

2. What is the best thing from the Virtual Beauty Advisor?

Participants were asked to think of the best thing or the most favorite thing that they found during the use of Virtual Try-On feature.

- The personalization of make-up style, skin condition, and skin tone that adjusts the final score.
- Participants can be educated through the score explanation about the suitable make-up look for their input.
- The recommendation that appears at the end of the score helps the participants to build a better make-up look.

3. What is the worst thing from the Virtual Beauty Advisor?

Participants were also asked to think of the worst thing they found on Virtual Try-On feature, as opposed to the previous question.

- The skin tone selection is limited and not inclusive enough.
- The score can be very subjective due to the number of experts used for the scoring system.

4. What are the recommendations that the participant can give to improve the Virtual Beauty Advisor?

- The knowledge of the scoring system should be updated periodically.
- The product category should be increased.
- The skin condition and skin tone selections should be completed with explanations.
- The skin tone selections should be completed with undertone selections.

4.5.2 User Scenario

User scenario is the storyline that shows how the user might act to achieve goals and solve the problems. User scenario that is created for this research shows how the user solves the problems using Virtual Beauty Advisor. The determination of user persona is determined as follows:

Name: Bella

Age: 22-year-old

Occupation: College student

Habit:

- Socializes with friends
- Involved in student organizations
- Gains information and accesses news through internet/social media
- Keeps up with trends, especially beauty trends

Goals:

- To have an efficient way of purchase decision making towards cosmetic products.
- To be able to filter which influencers' product recommendations are suitable for her.

Pain points:

- There is a lot of information available regarding new products launched by cosmetic brands and reviewed by beauty influencers. It


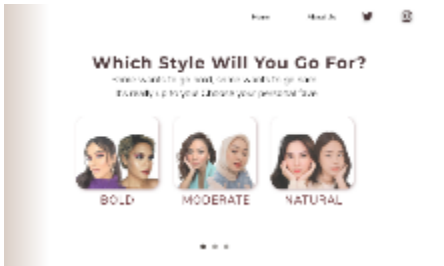
makes Bella overwhelmed on deciding which product is suitable for her.






- She is too busy to do offline shopping and try the product testers to see which product is suitable for her due to her busy activities of college and organizations.
- She is still unable to make decisions through online shopping because she cannot try the products on her face.






Scenario: There is an upcoming event where Bella has to wear make-up. But, she is currently running out of make-up and does not have time to go shopping. She could easily buy the products through online shop, but she is afraid that she chooses the wrong products that do not match her since she cannot try the products directly.





Virtual Beauty Advisor can help to solve the problems faced by user persona. Table 4.12 shows the steps that user takes in Virtual Beauty Advisor.



Table 4.12 Steps of Virtual Beauty Advisor

No	Steps	Visualization
1	Open the Virtual Beauty Advisor	
2	Click 'Start Now'	
3	Choose preferred make-up style	

No	Steps	Visualization
4	Choose skin condition	
5	Choose skin tone	
6	Load the virtual try-on	
7	Check the 'I Consent' box	
8	Click the "Live Try-On"	

No	Steps	Visualization
9	Choose the foundation product	
10	Choose the foundation shade	
11	Choose the eyebrow product	
12	Choose the eyebrow shade	
13	Choose the lipstick product	

No	Steps	Visualization
14	Choose the lipstick shade	 <p>The screenshot shows the product page for 'L'Oréal Infallible Pro-Matte Gloss'. On the left is a portrait of a woman with dark hair. On the right, the product name is displayed with a 4.5-star rating. Below the product name is a 'Color Selection' section with a row of 12 color swatches. The 10th swatch from the left is selected, indicated by a white circle with a checkmark. A 'Shop Now' button is at the bottom.</p>
15	Choose the blush product	 <p>The screenshot shows the product page for 'L'Oréal Le Bar A Blush'. On the left is a portrait of a woman with dark hair. On the right, the product name is displayed with a 4.5-star rating. Below the product name is a 'Color Selection' section with a row of 5 color swatches. The 2nd swatch from the left is selected, indicated by a white circle with a checkmark. A 'Shop Now' button is at the bottom.</p>
16	Choose the blush shade	 <p>The screenshot shows the product page for 'L'Oréal Le Bar A Blush'. On the left is a portrait of a woman with dark hair. On the right, the product name is displayed with a 4.5-star rating. Below the product name is a 'Color Selection' section with a row of 5 color swatches. The 3rd swatch from the left is selected, indicated by a white circle with a checkmark. A 'Shop Now' button is at the bottom.</p>
17	Choose the eyeshadow product	 <p>The screenshot shows the product page for 'L'Oréal Le Bar A Blush'. On the left is a portrait of a woman with dark hair. On the right, the product name is displayed with a 4.5-star rating. Below the product name is a 'Color Selection' section with a row of 5 color swatches. The 2nd swatch from the left is selected, indicated by a white circle with a checkmark. A 'Shop Now' button is at the bottom.</p>

No	Steps	Visualization
18	Choose the eyeshadow shade	
19	Click "I'm Done"	
20	Gain the result	

CHAPTER 5

ANALYSIS AND INTERPRETATION

This chapter presents the analysis and interpretation stage of the data processing done in previous chapters. After obtaining and processing the knowledge into case-based reasoning and visualizes it on the new interface design of Virtual Beauty Advisor, this stage is executed to discuss and interpret the results.

5.1 Analysis of Knowledge Management Model

This subchapter starts with the implementation of Nonaka-Takeuchi knowledge management model that can be seen in Figure 2.2. There are 4 types of conversions; socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit), and combination (explicit to tacit). There are only two conversions portrayed in this research. These conversions are portrayed in the knowledge exploration stage. It starts with capturing the knowledge from beauty experts which represents **externalization**. The knowledge owned by beauty experts is not properly documented as written theories. Thus, the conversion from undocumented knowledge to questionnaire responses is important to document the knowledge for the basis of the scoring system. There are several sections in the knowledge capturing questionnaire where each section indicates the product category of cosmetics that being displayed on Virtual Try-On; foundation, blush, eyeshadow, eyebrow, and lipstick.

Explicit knowledge was also obtained through official product descriptions to translate the characteristics ranked by beauty experts into several product selections. For example, in foundation section, the expert should rank several categories owned by L'Oreal Paris foundations (e.g. high coverage, sheer coverage, matte finish, and dewy finish). The foundation used for bold make-up style must be full coverage to gain the highest score according to the experts. So, the foundation that can be used to achieve the highest score is adjusted to which the product is claimed to be full coverage from the brand itself, and it can be seen in the official product description. Table 4.2 shows the implementation of **combination**. The

result of the drafted cases becomes the visualization of combination step in knowledge management mode after the drafted cases are made to be the standard of scoring system in case-based reasoning approach.

5.2 Analysis of Usability Testing Result

This subchapter presents the result of usability testing done in the previous chapter. The measurement of usability testing used in this research is through standardized usability questionnaire named PSSUQ. There are 4 types of scores obtained from PSSUQ; Overall score, System Usefulness score, Information Quality score, and Interface Quality score.

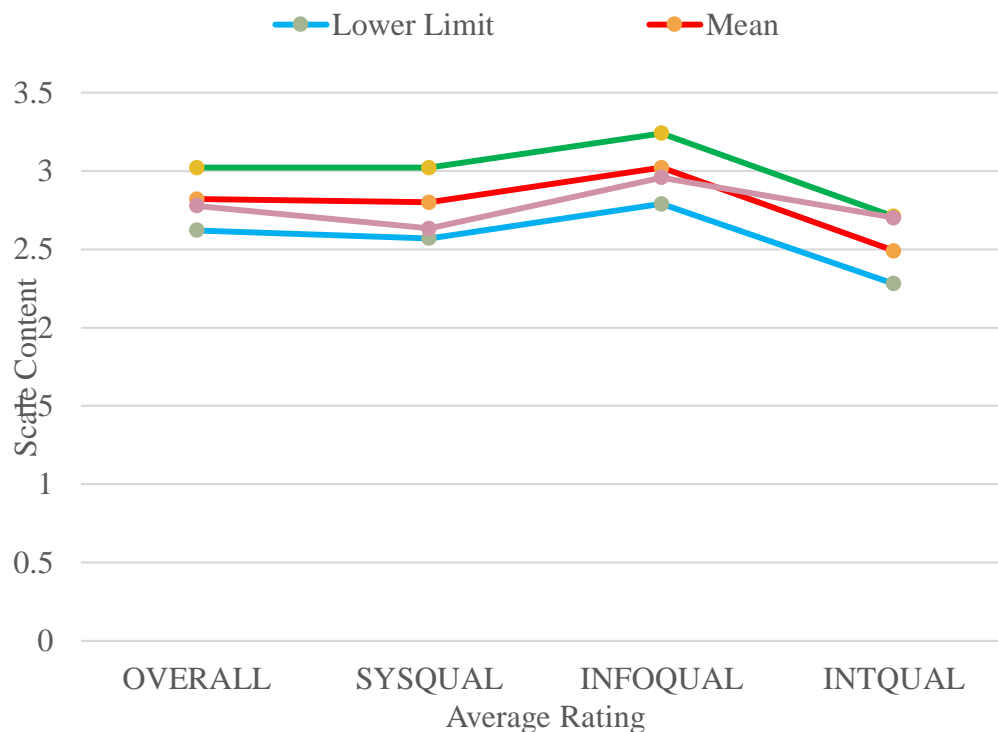


Figure 5.1 The Comparison of PSSUQ Norms and L'Oreal Virtual Try-On

The first one is the overall score that is calculated from all statements on the questionnaire. In the overall score, L'Oreal Virtual Try-On gained 2.78 while the mean is 2.82. This score is still on the norm's range because the lower limit from overall score is 2.62. It indicates that the current feature has already given the users

usability function and satisfaction. The next score is system usefulness. It is obtained from the calculation from statement 1 to statement 6 of PSSUQ. L'Oreal Virtual Try-On's System Usefulness score is still on the range of PSSUQ norms with 2.63. The same also goes to the Information Quality and Interface Quality score. It is found from the PSSUQ result that L'Oreal Virtual Try-On is already adequate. This could be because of the virtual try-on feature is a new technology that users rarely seen from other brands or companies. Thus, users already obtained satisfaction through the use of technology that is new to them. However, the experience was not perfect since several things troubled the users. There are several things captured from the think-aloud and open questionnaire that were frequently complained by the users:

- Not all of the displayed products are available to be virtually tried; instead, the site gives the notification of invalid products. This confused the users because the users did not understand the meaning of invalid products.
- The concealer feature did not work for the users. Most of them could not see the difference brought by the concealer feature.
- The mascara feature gives a difference to the users, but the difference between one product and another is indistinguishable.
- There are no information regarding the product description, while the feature itself cannot show the finish and texture of each product.
- The color payoff on the face is different from what is displayed on the color selection. This made the users confuse and could not decide which one worked best for them and their skin tone.

5.3 Analysis of Virtual Beauty Advisor Design

This subchapter analyzes the improvement made from the usability testing result in the development of Virtual Beauty Advisor design. The first thing displayed to the users is the landing page that presents a brief description of Virtual Beauty Advisor. Then, the user is allowed to choose the preferred make-up style. These selections are based on the beauty experts used in this research. There are 3 types of make-up styles; bold, moderate, and natural. The make-up style selection

feature was shown to the participants and the participants were allowed to rank their satisfaction towards the feature. Among 20 participants, 15 was strongly satisfied with the feature, 4 was satisfied, and 1 was neutral. This is meant that the feature gives a good addition that satisfies the users.

The score button is available when the user already chooses a product or more. This button appears on the display of product selection in Virtual Beauty Advisor. This design considers the feedback from the usability testing participants that demands for a brief description or information about the product. The score button can be selected when the user feels like they have completed a final make-up look. It appears on the bottom of product selections with “I’M DONE” written on it. The participants ranked this feature and 10 out of 20 were satisfied. 8 were satisfied and the rest were neutral. The amount of strongly satisfied participants was still higher than the other, which makes this feature as a good improvement to the system. The last feature was the result of the score. The users obtain the score that ranges from Low to High. It also has explanations regarding the score. When the users get the low score, the system explains the mismatched products that correlate with the selected make-up style, skin condition, and skin tone. The system also gives the product recommendations. The participants also ranked this feature. As a result, 14 participants were strongly satisfied with this feature. 5 participants were satisfied and 1 was neutral.

Participants also filled the open questionnaire to give feedback that cannot be covered by the Likert scale. The recapitulation of the open questionnaire’s answers shows that most of the participants feel the improvement is better than the current Virtual Try-On feature. All participants gave positive overall impressions toward the Virtual Beauty Advisor due to its ability to give automate and personalized score based on selected make-up style, skin condition, and skin tone. The ability to give the score explanation and product recommendations when the users gain the low or normal score was helpful for the participants. The participants felt that this function gives users higher confidence to decide whether a product is suitable for them. Although, there were also several negative things experienced by the participants with Virtual Beauty Advisor. Some participants felt that the score gained in the Virtual Beauty Advisor is subjective and does not represent wider

preferences. The selection of the skin tone has not been inclusive enough to represent all Indonesian skin tone. The recommendations given by the participants can be taken as the suggestions for upcoming research since this research limits the number of beauty experts used and the products selection used.

(This page is intentionally left blank)

CHAPTER 6

CONCLUSION AND SUGGESTION

This chapter is the last stage that concludes the overall findings of this research. It covers the conclusion and also the suggestions.

6.1 Conclusion

Several points conclude this research. These points are derived from the objectives of this research.

1. The knowledge regarding the make-up products for various make-up style, skin condition, and skin tone has been captured. There were two kinds of knowledge captured; tacit and explicit. Tacit knowledge was gained from beauty experts through the content of videos uploaded by the expert and also the direct interview. Explicit knowledge was gained from the official product description. The translation of the knowledge was adjusted to the product selections available on L'Oreal Virtual Try-On.
2. The knowledge obtained from the knowledge exploration stage was being drafted using case-based reasoning method. The knowledge was stored as 'old case' that can be retrieved in the case-based reasoning cycle. 54 old cases are collected and ranging from high score to low score of various make-up style, skin condition, and skin tone.
3. The design of the Virtual Beauty Advisor has been made with considering the result and recommendations from the participants in the usability testing. Virtual Beauty Advisor has several key elements that were added as the visualization of scoring system from the beauty experts' knowledge; the make-up style selection, the skin condition selection, the skin tone selection, the score button, and the result of the score. These improvements were shown to the participants and most of the participants were strongly satisfied with the improvement.

6.2 Suggestion

Several suggestions can be given from this research to be taken as a future improvement in the upcoming research.

1. The Virtual Try-On function is best performed on device with High-Definition (HD) camera with minimum 720p resolution.
2. The Virtual Try-On function is best performed when natural lighting is available. Otherwise, the artificial light that ranges between 120-250 LUX is also suitable.
3. The design of Virtual Beauty Advisor should be developed into a functioning prototype that can be tried by the users.
4. The knowledge from the experts should be enriched to give the more accurate result of the score.
5. The product selections should be increased to let the users try various make-up looks.

REFERENCES

- Aamodt, A., & Plaza, E. (1996). Case-based reasoning: Foundational issues, methodological variations, and system approaches. In *Artificial Intelligence Communications* (Vol. 7, Issue 1). <https://doi.org/10.3390/s120811154>
- Barnum, C. M. (2011). Usability Testing Essentials. *Usability Testing Essentials*, 1–7. <https://doi.org/10.1016/b978-0-12-375092-1.00012-x>
- Billinghurst, M., Clark, A., & Lee, G. (2015). *A Survey of Augmented Reality* (Vol. 8).
- Cheng, J. C. P., Chen, K., & Chen, W. (2017). *Comparison of Marker-Based and Markerless AR: A Case Study of An Indoor Decoration System*. July, 483–490. <https://doi.org/10.24928/jc3-2017/0231>
- Chopra, S. (2018). *Innovation trends and opportunities in cosmetics – Indonesia & Philippines*. https://korea.in-cosmetics.com/RXUK/RXUK_InCosmeticsKorea/responsive/presentations_marketing_trends_2018/Day_3_11.30_GLOBALDATA_in_English.pdf?v=636643770247096999
- EU-Indonesia Business Network. (2019). EIBN Sector Reports: Cosmetics. In *Indonesian French Chamber of Commerce and Industry*. https://indonesien.ahk.de/fileadmin/AHK_Indonesien/Publication/PDF_Publication/EIBN/2019_EIBN_New_Report_-_Sector_Cosmetics.pdf
- Gupta, A., Bansal, R., & Bansal, A. (2013). (PDF) Online Shopping: A Shining Future. *International Journal of Techno-Management Research*, 1(1), 1–10. https://www.researchgate.net/publication/318224640_Online_Shopping_A_Shining_Future
- ISO. (2018). *Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts*. <https://www.iso.org/standard/63500.html>
- Jacko, J. A. (2012). *Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition* (3rd ed.). CRC Press, Inc.
- Markopoulos, E., & Kornilakis, I. (2016). *True Knowledge in Knowledge*

Management , A True Knowledge in Knowledge Management , A Black Hole
January.

https://www.researchgate.net/publication/311428049_True_Knowledge_in_Knowledge_Management_A_Black_Hole

McDonald, S., Edwards, H. M., & Zhao, T. (2012). Exploring think-alouds in usability testing: An international survey. *IEEE Transactions on Professional Communication*, 55(1), 2–19. <https://doi.org/10.1109/TPC.2011.2182569>

Meixian, L. (2015). Convenience and online consumer shopping behavior: A business anthropological case study based on the contingent valuation method. *Anthropologist*, 21(1–2), 8–17. <https://doi.org/10.1080/09720073.2015.11891788>

Merle, A., Senecal, S., & St-Onge, A. (2012). Whether and how virtual try-on influences consumer responses to an apparel web site. *International Journal of Electronic Commerce*, 16(3), 41–64. <https://doi.org/10.2753/JEC1086-4415160302>

Radgah, J., & Faghihi, A. (2015). *The Ways of Using Nonaka Model of Knowledge Management in Organizations*. 5, 263–272.

Rauschnabel, P. A., Felix, R., & Hinsch, C. (2019). Augmented reality marketing: How mobile AR-apps can improve brands through inspiration. *Journal of Retailing and Consumer Services*, 49(November 2018), 43–53. <https://doi.org/10.1016/j.jretconser.2019.03.004>

Rubin, J., & Chisnell, D. (2008). *Handbook of Usability Testing* (2nd editio). Wiley Publishing, Inc.

Sauro, J., & Lewis, J. R. (2012). *Quantifying The User Experience* (1st ed.). Morgan Kaufman.

Waqar, M. M., Aslam, M., Usman, M. G., & Martinez-Enrriquez, A. M. (2013). Wearable items suggestion system using case based reasoning. *2013 10th International Conference on Electrical Engineering, Computing Science and Automatic Control, CCE 2013*, 286–291. <https://doi.org/10.1109/ICEEE.2013.6676035>

ZAP. (2018). *ZAP Beauty Index 2018*. <http://zapclinic.com/zapbeautyindex>

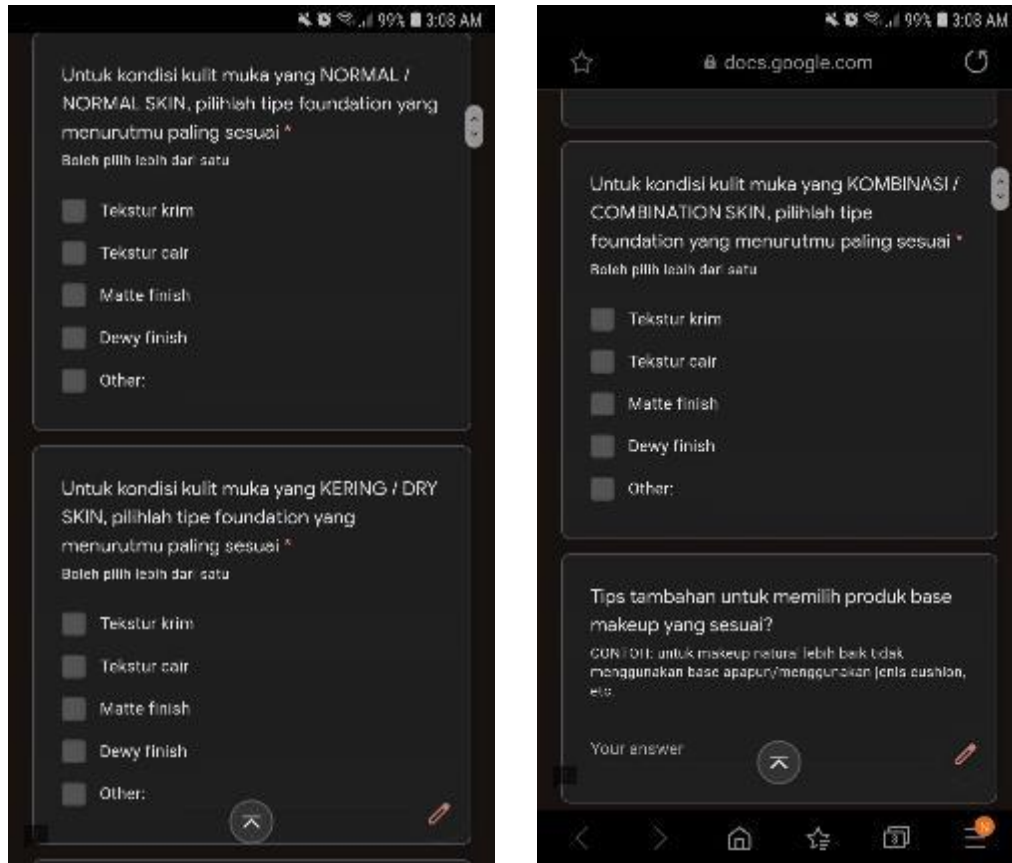
ZAP. (2020). *ZAP Beauty Index 2020*. <http://zapclinic.com/zapbeautyindex>

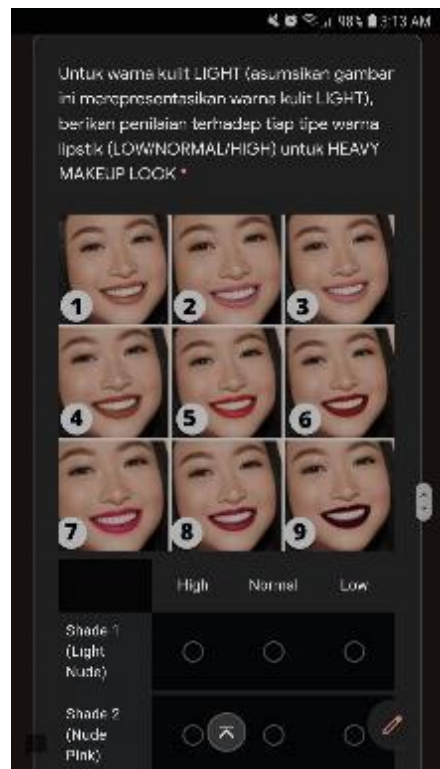
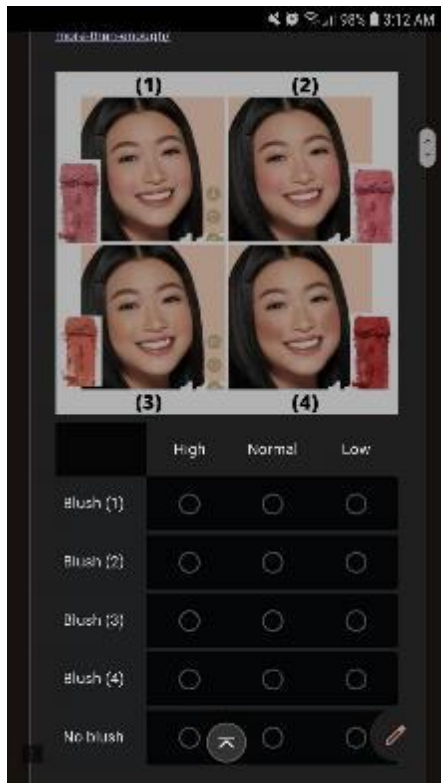
- Zhang, T., Wang, W. Y. C., Cao, L., & Wang, Y. (2019). The role of virtual try-on technology in online purchase decision from consumers' aspect. *Internet Research*, 29(3), 529–551. <https://doi.org/10.1108/IntR-12-2017-0540>
- Zia, S. S., Akhtar, P., Hussain, R., & Mala, I. (2014). CBR: Cycle, framework and applications. *World Applied Sciences Journal*, 32(7), 1349–1355. <https://doi.org/10.5829/idosi.wasj.2014.32.07.489>

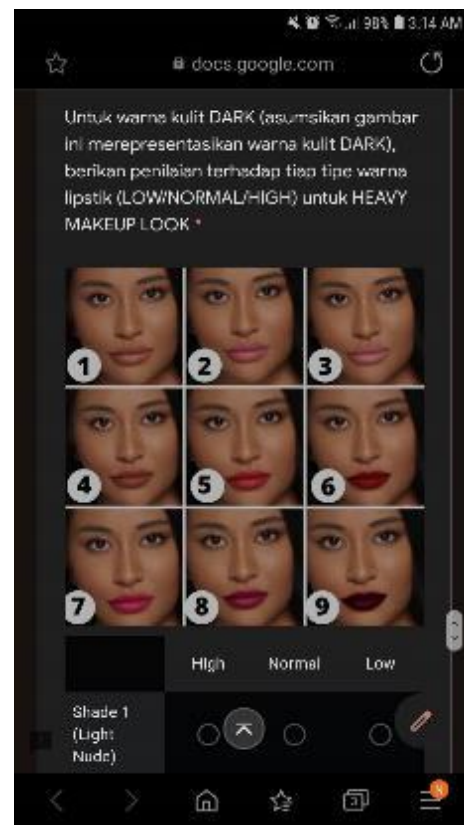
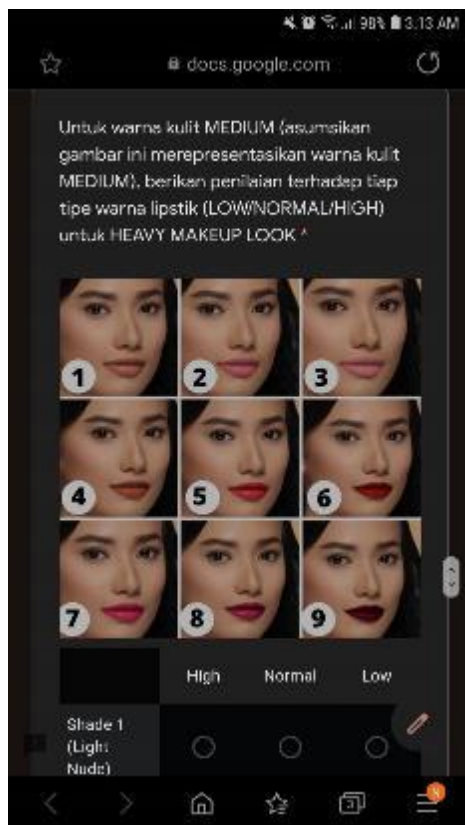
(This page is intentionally left blank)

ATTACHMENT

Attachment 1: Knowledge Capturing Questionnaire







No eyebrow

This question requires one response per row.

Untuk makeup level yang MODERATE (contoh; untuk casual hangout, lebaran, day event, dll.), sesuaikan tipe eyebrow dibawah ini berdasarkan score HIGH/NORMAL/LOW *

	High	Normal	Low
Tekstur krim	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tekstur bubuk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pigmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-pigmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No eyebrow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Untuk makeup level yang MODERATE

6. EYEBROW
(HANG OUT, SEBENTAR LAGI SESIAL)
Section ini membahas mengenai pemilihan produk eyebrow yang sesuai dengan makeup level/wacanan.

Untuk makeup level yang HEAVY (contoh; untuk acara pesta/night event, wisuda, dll.), sesuaikan tipe eyebrow dibawah ini berdasarkan score HIGH/NORMAL/LOW *

	High	Normal	Low
Tekstur krim	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tekstur bubuk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pigmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-pigmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No eyebrow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

This question requires one response per row.

Urutkan dan 1 (paling penting) sampai 6 (paling tidak penting) faktor-faktor berikut dalam mencapai makeup look yang sempurna *

	1	2	3	4
Pemilihan warna dan tipe foundation yang tepat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pemilihan warna blush yang tepat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pemilihan warna eyeshadow yang tepat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pemilihan warna dan tipe lipstick yang tepat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pemilihan tipe eyebrow yang tepat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

apakah yang tepat

Pemilihan tipe eyebrow yang tepat

This question requires one response per row.

TIPS / SARAN / MASUKAN LAIN UNTUK KUISIONER DAN TEKNIK PEMILIHAN MAKEUP?

I could not be more thankful to you! Terima kasih banyak sudah meluangkan waktu di kuisisioner yang super panjang ini! hope it all will paid off to you, kind soul <3 kalau ada saran atau masukan mengenai perubahan apapun teknik makeup dan apapun kuisisioner ini, let me know!

Your answer

Submit

Never submit passwords through Google Forms

This content is visible to anyone who has access to this form. [Learn More](#) - [Terms of Service](#) - [Privacy Policy](#)

Google Forms

Attachment 2: Drafted Old Cases for Case-based Reasoning

CASE 1			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Normal skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory 102 Shell Beige
		Infallible 24H Liquid Fresh Foundation	020 Ivory 130 True Beige
		True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla
	Blush	Le Bar a Blush	01 More Than Enough 10 Play
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 435 Crystal Shine 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
	Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist

CASE 1

Objective	Building a HIGH score for Bold make-up style		
Obtained data	Normal skin type		
	Light skintone		
			358 Cowboy 362 Plum Bum 366 Stirred 370 Roseblood
		Infallible Pro-Matte Gloss	301 Blushing Ambition 318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss 314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
	Brow Artist Genius Kit	Light to Medium Medium to Dark	

CASE 2			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Dry skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	020 Ivory 130 True Beige
		True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla
	Blush	Le Bar a Blush	01 More Than Enough 10 Play
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 435 Crystal Shine 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist 358 Cowboy 362 Plum Bum 366 Stirred	

CASE 2		
Objective	Building a HIGH score for Bold make-up style	
Obtained data	Dry skin type	
	Light skintone	
		370 Roseblood
		301 Blushing Ambition 318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss 314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
Brow Artist Genius Kit		Light to Medium Medium to Dark

CASE 3			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory 102 Shell Beige

CASE 3			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
		Infallible 24H Liquid Fresh Foundation	020 Ivory 130 True Beige
	Blush	Le Bar a Blush	01 More Than Enough 10 Play
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 435 Crystal Shine 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
	Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist 358 Cowboy 362 Plum Bum 366 Stirred 370 Roseblood
		Infallible Pro-Matte Gloss	301 Blushing Ambition

CASE 3			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
			318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss 314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
Brow Artist Genius Kit		Light to Medium Medium to Dark	

CASE 7			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	104 Golden Beige 105 Natural Beige

CASE 7			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
			106 Sun Beige
		Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand 220 Sand
		True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla G3 Gold Vanilla N4 Nude Beige G4 Gold Beige
	Blush	Le Bar a Blush	03 I Have A Dream

CASE 8			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Combination skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand

		220 Sand
	True Match Liquid Foundation	G3 Gold Vanilla N4 Nude Beige G4 Gold Beige
	True Match Cushion Foundation	G1 Gold Ivory N1 Nude Ivory
Blush	Le Bar a Blush	03 I Have A Dream

CASE 9			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Normal skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	107 Fresh Beige 110 Crème Café
		Infallible 24H Liquid Fresh Foundation	140 Golden Beige 150 Radiant Beige 250 Radiant Sand
		True Match Liquid Foundation	G5 Gold Cream N7 Nude Ambre
		True Match Cushion Foundation	G3 Gold Vanilla
		(X) NO FOUNDATION	
		Blush	Le Bar a Blush	11 Be Fearless
	(X) NO BLUSH		
	Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
		(X) NO EYESHADOW	

Lipstick	(X) NO LIPSTICK	
Eyebrow	(X) NO EYEBROW	

CASE 10			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Dry skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory
			102 Shell Beige
			104 Golden Beige
			105 Natural Beige
			106 Sun Beige
	Foundation	Infallible 24H Liquid Fresh Foundation	107 Fresh Beige
			110 Crème Café
140 Golden Beige			
Foundation	True Match Liquid Foundation	150 Radiant Beige	
		250 Radiant Sand	
Blush	True Match Cushion Foundation	G5 Gold Cream	
		N7 Nude Ambre	
		(X) NO FOUNDATION	
		Le Bar a Blush	11 Be Fearless
		(X) NO BLUSH	

CASE 10			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Dry skin type		
	Light skintone		
	Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
		(X) NO EYESHADOW	
	Lipstick	(X) NO LIPSTICK	
	Eyebrow	(X) NO EYEBROW	

CASE 11			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
Solution	Product	Name	Shade
	Foundation	True Match Cushion Foundation	G1 Gold Ivory N1 Nude Ivory G3 Gold Vanilla
		Infallible Pro-Matte 24H Foundation	107 Fresh Beige 110 Crème Café
		Infallible 24H Liquid Fresh Foundation	140 Golden Beige 150 Radiant Beige 250 Radiant Sand
		True Match Liquid Foundation	G5 Gold Cream N7 Nude Ambre
		(X) NO FOUNDATION	

CASE 11			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Oily skin type		
	Light skintone		
	Blush	Le Bar a Blush	11 Be Fearless
		(X) NO BLUSH	
	Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
		(X) NO EYESHADOW	
	Lipstick	(X) NO LIPSTICK	
Eyebrow	(X) NO EYEBROW		

CASE 12				
Objective	Building a LOW score for Bold make-up style			
Obtained data	Combination skin type			
	Light skintone			
Solution	Product	Name	Shade	
	Foundation	Infallible Pro-Matte 24H Foundation	107 Fresh Beige 110 Crème Café	
		Infallible 24H Liquid Fresh Foundation	140 Golden Beige 150 Radiant Beige 250 Radiant Sand	
		True Match Liquid Foundation	G5 Gold Cream N7 Nude Ambre	
		True Match Cushion Foundation	G3 Gold Vanilla	
		(X) NO FOUNDATION		

	Blush	Le Bar a Blush	11 Be Fearless
		(X) NO BLUSH	
	Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
		(X) NO EYESHADOW	
	Lipstick	(X) NO LIPSTICK	
	Eyebrow	(X) NO EYEBROW	

CASE 14				
Objective	Building a NORMAL score for Moderate make-up style			
Obtained data	Normal/dry/oily/combo skin type			
	Medium skintone			
Solution	Product	Name	Shade	
	Foundation	True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla G3 Gold Vanilla N4 Nude Beige G4 Gold Beige	
			Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand 220 Sand
			True Match Cushion Foundation	G1 Gold Ivory
	Blush	Le Bar a Blush	03 I Have A Dream	
		(X) NO BLUSH		
	Eyeshadow	Shimmer Liquid Eye Shadow	425 Amethyst Quartz 445 Crown Gold	

(X) NO EYESHADOW

CASE 15

Objective	Building a LOW score for Moderate make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Medium skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory
			102 Shell Beige
			104 Golden Beige
			105 Natural Beige
			106 Sun Beige
	107 Fresh Beige		
	110 Crème Café		
	Foundation	Infallible 24H Liquid Fresh Foundation	140 Golden Beige
			150 Radiant Beige
250 Radiant Sand			
Foundation	True Match Liquid Foundation	G5 Gold Cream N7 Nude Ambre	
Foundation	True Match Cushion Foundation	G3 Gold Vanilla	
Foundation	(X) NO FOUNDATION		
Blush	Le Bar a Blush	11 Be Fearless	
Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls	
Lipstick	(X) NO LIPSTICK		
Eyebrow	(X) NO EYEBROW		

CASE 26			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Combination skin type		
	Medium skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	020 Ivory 130 True Beige 140 Golden Beige 150 Radiant Beige 250 Radiant Sand
		True Match Liquid Foundation	G1 Gold Ivory G2 Gold Porcelain N3 Nude Vanilla G5 Gold Cream N7 Nude Ambre
		True Match Cushion Foundation	G1 Gold Ivory N1 Nude Ivory G3 Gold Vanilla
Blush	Le Bar a Blush	01 More Than Enough 11 Be Fearless	

CASE 27			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Normal skin type		
	Medium skintone		
Solution	Product	Name	Shade

Foundation	(X) NO FOUNDATION	
Blush	(X) NO BLUSH	
Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
	(X) NO EYESHADOW	
Lipstick	Infallible Pro-Matte Gloss	301 Blushing Ambition
	(X) NO LIPSTICK	
Eyebrow	(X) NO EYEBROW	

CASE 28			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Dry skin type		
	Medium skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory 102 Shell Beige 104 Golden Beige 105 Natural Beige 106 Sun Beige 107 Fresh Beige 110 Crème Café
			(X) NO FOUNDATION
	Blush	(X) NO BLUSH	
	Eyeshadow	Shimmer Liquid Eye Shadow	410 String of Pearls
		(X) NO EYESHADOW	
	Lipstick	Infallible Pro-Matte Gloss	301 Blushing Ambition
		(X) NO LIPSTICK	

CASE 28			
Objective	Building a LOW score for Bold make-up style		
Obtained data	Dry skin type		
	Medium skintone		
CASE 36			
Objective	Building a LOW score for Natural make-up style		
Obtained data	Normal/dry/oily/combination skin type		
	Medium skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory 102 Shell Beige 104 Golden Beige 105 Natural Beige 106 Sun Beige 107 Fresh Beige 110 Crème Café
	Eyeshadow	Shimmer Liquid Eye Shadow	425 Amethyst Quartz 445 Crown Gold 410 String of Pearls
	Lipstick	Infallible Pro-Matte Liquid	362 Plum Bum 370 Roseblood
Infallible Pro-Matte Gloss		301 Blushing Ambition 362 Plum Bum 366 Stirred 370 Roseblood	

CASE 37			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Normal skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	107 Fresh Beige 110 Crème Café
		Infallible 24H Liquid Fresh Foundation	140 Golden Beige 150 Radiant Beige 250 Radiant Sand
		True Match Liquid Foundation	G5 Gold Cream N7 Nude Ambre
	Blush	Le Bar a Blush	01 More Than Enough 10 Play With Me 11 Be Fearless
	Eyeshadow	Shimmer Liquid Eye Shadow	425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
	Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist 358 Cowboy 362 Plum Bum 366 Stirred

CASE 37			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Normal skin type		
	Tan skintone		
			370 Roseblood
		Infallible Pro-Matte Gloss	318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss 314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
Brow Artist Genius Kit		Light to Medium Medium to Dark	

CASE 38			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Dry skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	115 Nude Beige 125 Natural Rose
		True Match Liquid Foundation	G5 Gold Cream

CASE 38			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Dry skin type		
	Tan skintone		
			N7 Nude Ambre
	Blush	Le Bar a Blush	01 More Than Enough 10 Play With Me 11 Be Fearless
	Eyeshadow	Shimmer Liquid Eye Shadow	425 Amethyst Quartz 430 Blush Jewel 455 Bronze Light 445 Crown Gold 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx
	Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion 354 Nudist 358 Cowboy 362 Plum Bum 366 Stirred 370 Roseblood
Infallible Pro-Matte Gloss		318 Barre Attraction 316 Statement Nude 304 Rebel Rose 310 Forbidden Kiss	

CASE 38			
Objective	Building a HIGH score for Bold make-up style		
Obtained data	Dry skin type		
	Tan skintone		
			314 Nude Allude 312 Rouge Envy 302 Fuchsia Amnesia
	Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown Dark Brown Grey Atelier
Brow Artist Genius Kit		Light to Medium Medium to Dark	

CASE 41			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Normal skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	Infallible Pro-Matte 24H Foundation	104 Golden Beige 105 Natural Beige 106 Sun Beige
		Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand 220 Sand
		True Match Liquid Foundation	G3 Gold Vanilla N4 Nude Beige

CASE 41			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Normal skin type		
	Tan skintone		
			G4 Gold Beige
		True Match Cushion Foundation	G1 Gold Ivory G3 Gold Vanilla
	Blush	(X) NO BLUSH	
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 435 Crystal Shine
	Lipstick	Infallible Pro-Matte Gloss	301 Blushing Ambition
		(X) NO LIPSTICK	
Eyebrow	(X) NO EYEBROW		

CASE 42			
Objective	Building a NORMAL score for Bold make-up style		
Obtained data	Dry skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand 220 Sand
		True Match Liquid Foundation	G3 Gold Vanilla N4 Nude Beige G4 Gold Beige
		True Match Cushion Foundation	G1 Gold Ivory N1 Nude Ivory

		True Match Cushion Foundation	G1 Gold Ivory G3 Gold Vanilla
	Blush	(X) NO BLUSH	
	Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop 440 Amber Sparkle 435 Crystal Shine
	Lipstick	Infallible Pro-Matte Gloss	301 Blushing Ambition
		(X) NO LIPSTICK	
	Eyebrow	(X) NO EYEBROW	

CASE 52			
Objective	Building a HIGH score for Natural make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	True Match Cushion Foundation	G3 Gold Vanilla
	Blush	Le Bar a Blush	01 More Than Enough 10 Play With Me 11 Be Fearless
	Eyeshadow	Shimmer Liquid Eye Shadow	440 Amber Sparkle 455 Bronze Light 435 Crystal Shine 450 Precious Lava 460 Radiant Ruby 420 Rose Gem 465 Royal Onyx

CASE 52			
Objective	Building a HIGH score for Natural make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Tan skintone		
Lipstick	Infallible Pro-Matte Liquid Lipstick	372 Petal Potion	
		354 Nudist	
Lipstick	Infallible Pro-Matte Gloss	358 Cowboy	
		366 Stirred	
Eyebrow	Brow Artist Designer Pro 3-in-1	318 Barre	
		Attraction	
Eyebrow	Brow Artist Genius Kit	316 Statement	
		Nude	
Eyebrow	Brow Artist Designer Pro 3-in-1	314 Nude Allude	
		312 Rouge Envy	
Eyebrow	Brow Artist Designer Pro 3-in-1	Light Brown	
		Dark Brown	
Eyebrow	Brow Artist Designer Pro 3-in-1	Grey Atelier	
		Light to Medium	
Eyebrow	Brow Artist Designer Pro 3-in-1	Medium to Dark	

CASE 53			
Objective	Building a NORMAL score for Natural make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Tan skintone		
Solution	Product	Name	Shade
	Foundation	Infallible 24H Liquid Fresh Foundation	125 Natural Rose 200 Golden Sand

CASE 53

Objective	Building a NORMAL score for Natural make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Tan skintone		
			220 Sand 140 Golden Beige 150 Radiant Beige 250 Radiant Sand
		True Match Liquid Foundation	G3 Gold Vanilla N4 Nude Beige G4 Gold Beige G5 Gold Cream N7 Nude Ambre
		True Match Cushion Foundation	G1 Gold Ivory
		(X) NO FOUNDATION	
	Blush	Le Bar a Blush	03 I Have A Dream
		(X) NO BLUSH	
	Eyeshadow	(X) NO EYESHADOW	
	Lipstick	(X) NO LIPSTICK	
Eyebrow	(X) NO EYEBROW		

CASE 54

Objective	Building a LOW score for Natural make-up style			
Obtained data	Normal/dry/oily/combo skin type			
	Tan skintone			
Solution	Product	Name	Shade	
	Foundation	Infallible Pro-Matte 24H Foundation	101 Classic Ivory	
			102 Shell Beige	
			104 Golden Beige	
			105 Natural Beige	
				106 Sun Beige
				107 Fresh Beige
				110 Crème Café
		Infallible 24H Liquid Fresh Foundation	020 Ivory	
			130 True Beige	
	True Match Liquid Foundation	G1 Gold Ivory		
		G2 Gold Porcelain		
		N3 Nude Vanilla		
	True Match Cushion Foundation	N1 Nude Ivory		
Eyeshadow	Shimmer Liquid Eye Shadow	415 Diamond Drop		
		425 Amethyst		
		Quartz		
		430 Blush Jewel		
		445 Crown Gold		
	410 String of Pearls			
	Infallible Pro-Matte Liquid	362 Plum Bum		
		370 Roseblood		
	Infallible Pro-Matte Gloss	301 Blushing		
		Ambition		
		304 Rebel Rose		
		310 Forbidden Kiss		

CASE 54

Objective	Building a LOW score for Natural make-up style		
Obtained data	Normal/dry/oily/combo skin type		
	Tan skintone		
			302 Fuchsia Amnesia

Attachment 3: Post Study System Usability Questionnaire Result

Co de	Statements	Roos Nabila Deiazalfa	Indira Ardiyatna	adela	April	Nabila Aulia Putri	Hanan	Manda	Nisrina Az Zahra	Virna Septianingtyas	naurania nadif	Saskia Putri Kamal	Khiffi Haya Trisetya	Anggi Prienda Sukma	Nisrina Hasna Ritonga	Safira Aprilia	Laras Widya Safitri	gieza	Muthia	Fairus Fardania	lydia	AVER AGE
1	Overall, I am satisfied with how easy it is to use this system.	2	2	5	4	3	5	2	1	2	3	3	2	3	2	4	3	2	3	3	5	2.95
2	It was simple to use this system.	2	1	2	2	1	3	3	2	2	2	2	3	4	1	3	2	2	2	2	3	2.2
3	I was able to complete the tasks and scenarios quickly using this system.	2	2	6	2	1	5	3	2	1	2	2	3	3	1	5	3	2	3	2	3	2.65
4	I felt comfortable using this system.	5	1	3	3	2	3	3	1	2	2	4	2	3	1	5	3	5	5	3	4	3
5	It was easy to learn to use this system.	3	1	1	2	1	6	2	1	1	2	2	1	4	1	3	3	1	3	2	3	2.15
6	I believe I could become productive quickly using this system.	3	2	4	2	2	5	3	1	1	2	4	2	3	1	4	4	3	3	3	5	2.85

Co de	Statements	Roos Nabila Deiazalfa	Indira Ardiyatna	adela	April	Nabila Aulia Putri	Hanan	Manda	Nisrina Az Zahra	Virna Septianingtyas	naurania nadif	Saskia Putri Kamal	Khifti Haya Trisetya	Anggi Prienda Sukma	Nisrina Hasna Ritonga	Safira Aprilia	Laras Widya Safitri	gieza	Muthia	Fairus Fardania	lydia	AVER AGE
7	The system gave error messages that clearly told me how to fix problems.	6	1	6	3	6	3	3	2	3	3	5	3	5	3	6	3	5	5	4	2	3.85
8	Whenever I made a mistake using the system, I could recover easily and quickly.	3	1	5	1	2	3	3	2	1	2	3	2	5	1	6	4	7	3	4	1	2.95
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.	5	1	2	3	3	2	5	2	1	2	3	1	6	2	5	5	2	2	3	2	2.85
10	It was easy to find the information I needed.	2	2	2	5	2	3	3	1	1	2	4	1	4	2	5	4	2	6	2	3	2.8
11	The information was effective in helping me	2	2	2	4	2	5	2	1	1	2	2	2	3	1	4	3	2	5	2	3	2.5

Co de	Statements	Roos Nabila Deiazalfa	Indira Ardiyatna	adela	April	Nabila Aulia Putri	Hanan	Manda	Nisrina Az Zahra	Virna Septianingtyas	naurania nadif	Saskia Putri Kamal	Khifti Haya Trisetya	Anggi Prienda Sukma	Nisrina Hasna Ritonga	Safira Aprilia	Laras Widya Safitri	gieza	Muthia	Fairus Fardania	lydia	AVER AGE
	complete the tasks and scenarios.																					
12	The organization of information on the system screens was clear.	5	2	2	2	2	5	2	1	1	2	3	4	3	1	5	3	2	5	3	3	2.8
13	The interface of this system was pleasant.	4	1	1	2	2	3	1	4	2	3	4	3	3	1	3	2	1	3	3	4	2.5
14	I liked using the interface of this system.	3	1	2	2	2	4	1	4	3	2	3	3	3	1	4	1	1	3	3	4	2.5
15	This system has all the functions and capabilities I expect it to have.	3	3	4	4	3	5	1	1	2	1	1	2	4	2	5	4	3	4	4	6	3.1
16	Overall, I am satisfied with this system.	3	2	3	4	2	5	1	1	1	2	2	2	3	2	5	3	4	4	3	4	2.8
	AVERAGE	3. 3 1	1. 5 6	3. 1 3	2. 8 1	2. 2 5	4. 0 6	2. 3 8	1. 6 9	1. 5 6	2. 1 3	2. 9 4	2. 2 5	3. 6 9	1. 4 4	4. 5 0	3. 1 3	2. 7 5	3. 6 9	2. 8 8	3. 4 4	2.78

Co de	Statements	Roos Nabila Deiazalfa	Indira Ardiyatna	adela	April	Nabila Aulia Putri	Hanan	Manda	Nisrina Az Zahra	Virna Septianingtyas	naurania nadif	Saskia Putri Kamal	Khifti Haya Trisetya	Anggi Prienda Sukma	Nisrina Hasna Ritonga	Safira Aprilia	Laras Widya Safitri	gieza	Muthia	Fairus Fardania	lydia	AVER AGE
		System Usefulness	2. 8 3	1. 5 0	3. 5 0	2. 5 0	1. 6 7	4. 5 0	2. 6 7	1. 3 3	1. 5 0	2. 1 7	2. 8 3	2. 1 7	3. 3 3	1. 1 7	4. 0 0	3. 0 0	2. 5 0	3. 1 7	2. 5 0	3. 8 3
Information Quality	3. 8 3	1. 5 0	3. 1 7	3. 0 0	2. 8 3	3. 5 0	3. 0 0	1. 5 0	1. 3 3	2. 1 7	3. 3 3	2. 1 7	4. 3 3	1. 6 7	5. 1 7	3. 6 3	3. 3 3	4. 3 3	3. 0 0	2. 3 3	2.96	
Interface Quality	3. 3 3	1. 6 7	2. 3 3	2. 6 7	2. 3 3	4. 0 0	1. 0 0	3. 0 0	2. 3 3	2. 0 0	2. 6 7	2. 6 7	3. 3 3	1. 3 3	4. 0 0	2. 3 3	1. 6 7	3. 3 3	3. 3 3	4. 6 7	2.70	

AUTHOR BIOGRAPHY



The author of this research is Aisha Rana Sabhira. She was born in Surabaya, on 17th December 1998. She was a former student of SDN Ketabang Kawasan Surabaya (2004-2010), SMP Negeri 1 Surabaya (2010-2013), and SMA Negeri 2 Surabaya (2013-2016). She continued her study in Institut Teknologi Sepuluh Nopember (2016-2020) and took Industrial and Systems Engineering major. During her study in college, she started exploring the opportunity to find her interest in academic or professional matters. She took part in several student events as committee, such as GERIGI ITS 2017, YES Summit 2017, and Ini Lho ITS 2018. She was also honored to become a Head of Internationalization Bureau in Himpunan Mahasiswa Teknik Industri ITS (HMTI ITS) 2018/2019 and Media Relation Staff in Badan Eksekutif Mahasiswa ITS (BEM ITS) 2018/2019. It was always in her dream to have international exposure on her experience, and she was chosen as the student representative for ITS Goes Beyond 2018 to Singapore. On 2019, she was also selected to represent the campus on Kumamoto University Spring Program. During her academic years, she found passion in cognitive ergonomic field of study. She started studying Adobe XD in her third year of college. Thus, she decided to focus on cognitive ergonomic field as the topic of her final project. She has a plan to become a user experience researcher or designer.