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DEVELOPMENT OF MOBILE APPLICATION M-EPIER USING MDA FRAMEWORK

Sri Puji Utami A[1], Puspa Setia Pratiwi[2], Nurmaya[3]
Department of Information Technology, YARSI University[1], Department of Bioinformatics, Indonesia International Institute for Life-Sciences[2], Department of Information Technology, YARSI University[3]
Email: sripujiutami@gmail.com, 2puspa.pratiwi@i3l.ac.id, nurmaya@yarsi.ac.id

Abstract

In this study, a mobile application, named M-Epier (Mobile Career Explorationr, which works on Android devices. In particular, this app aims for career development and exploration questionnaire as the measuring too, as well as for increasing knowledge and awareness about the career environment. This application development applies the concept of gamification with the MDA (Mechanics Dynamics Aesthetics) Framework. With that being said, gamification makes users become more motivated to do the questionnaires and the user experience more enjoyable. The system testing is done using the UEQ (User Experience Questionnaire) with a sample of 30 respondents aged 17 to 20 years old. The test results are positive for each UEQ scale with an average value of 'excellent'. Meanwhile, the functional testing uses questionnaire with 25 input and output scenarios which results in overall value of 'valid'. This shows that both in terms of appearance and function M-Epier is in accordance with the needs of users.

Keywords: Career Exploration; MDA; Epier; Android

Introduction

Career is a long-term ambition or life goal that is pursued and believed to be a calling for life, while work refers to activities that produce goods and services. In general, psychologists use a personal approach to determine a person's career development, such as counseling and giving questionnaires with theories that have been adapted to the behavior of Indonesian people. However, to get the results, it takes quite a long time. In 2015, a web-based Career Planning System (SICAKAR) was created to analyze and process questionnaires(Utami et al., 2018), as shown in Figure 1. The website utilizes an information system and several measurement methods, such as Career Orientation, Career Decision Making Self Efficacy (CDSME), Anchor Career, Holland's Interests, PGI, Support and Barrier, and Career Exploration(Utami et al., 2018). This research has been ongoing since January 2014 and was conducted by the Faculty of Psychology and Information Technology, Yarsi University

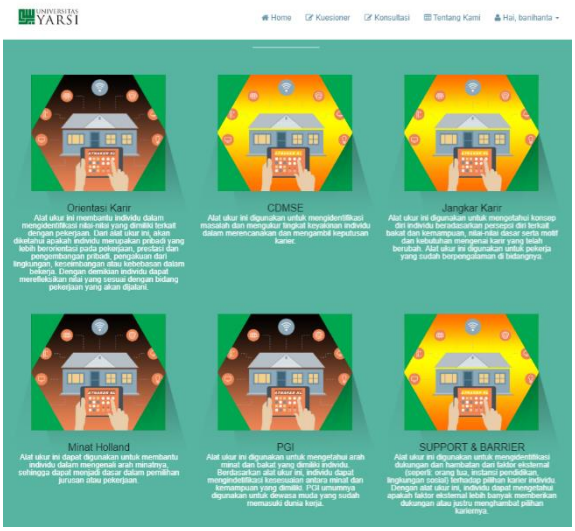

Figure 1
SICAKAR's Homepage

However, the interface which is still very simple, as shown in Figures 1 and 2, and the large number of questionnaires tend to make it to be boring for users, especially adolescents, resulting in negative behavior. The behavior caused is in the form of working too quickly, haphazard answers or responses, stopping work, and lack of attention to the questions being worked on (Harms et al., 2015b).

To avoid a monotonous, bureaucratic and boring user interface, interactive games are added to the non-game system in the fields of education, health, business, surveys or online questionnaires and so on, which is called the concept of gamification. Gamification is literally defined as the use of game elements in a non-gaming context, a system that uses game-based mechanics, dynamics and aesthetics to attract and engage users, motivate actions, promote learning and solve problems (Harms et al., 2015a). However, despite using game mechanics, the application of gamification is not always in the form of a game but how to build the user's willingness to participate (engagement) without realizing it.

In this study, the author tries to build an M-Epier (Mobile Career Exploration) application and build an Epier game using the concept of gamification. Then, to determine the M-Epier design that suits the user's needs, the author applies the GDS (Google Design Sprints) Method. Meanwhile, to create a game design the author uses the MDA (mechanics-dynamics-aesthetics) Framework which can implement the design process into several areas of the questionnaire such as introduction, questions, answers, navigation and submission with 5 stages(Utami et al., 2018), which is as follows:

1. *Game Elements for Inspiration*
2. *Aesthetics and the Relationship Layer*
3. *Dynamics and the Conversation Layer*
4. *Mechanics and the Conversation & Appearance Layers*
5. *Prototyping, Evaluation and Iteration.*

Therefore, by applying gamification to the career exploration questionnaire, it will facilitate the use of the questionnaire, triggering users to be more active and motivated when working on the questionnaire and can increase the user's understanding of his/her readiness to set goals in the career planning process. This is supported by the research of Edwin A. Locke which revealed that setting goals in life can motivate a person to do a better job. In an agency, employees with clear goals work more optimally than those who are not directed. This is because, determining and planning goals effectively is a requirement that will affect one's career success (Liu, 2017a).

The weakness of the web version of SICAKAR is that the access is still quite slow and complicated and the display is still not attractive. As a result, questionnaires tend to be tedious, less attractive to users and the available information is not sufficiently supportive. How to build M-Epier by applying the concept of gamification to the career exploration questionnaire and identifying its obstacles. The development of M-Epier aims to trigger users to be more active and motivated while working on career exploration questionnaires with easy access and attractive features. Its main benefit is to provide information for users who want to increase their understanding of their readiness to set goals in the career planning process.

Web and mobile-based application technology has been used in several areas of human life such as in the health education(Utami, 2016) and medical (Pratiwi & Lestari, 2012) fields. One of the methods at this stage used by the author as the foundation of the design project is the Design Principles method which will be useful in the product development process.

One method in the application design process, especially game applications, is to use the MDA Framework(Harms et al., 2015a). This framework consists of three layers of form design (mechanics, dynamics and aesthetics). The framework can be applied to a variety of survey areas or questionnaire areas. The M-Epier application uses the concept of gamification to create game designs. The author uses the MDA Framework which can implement the design process into several areas. The development of M-Epier aims to trigger users to be more active and motivated while working on career exploration questionnaires with easy access and attractive appearance. Its main benefit is to provide information for users who want to increase their understanding of their readiness to set goals in the career planning process.

According to (Liu, 2017b), career planning is one aspect of modern society's self-development and has an important value for individual career development at the career exploration stage. This exploration consists of three sub-stages, namely at the age of 15-17 years when adolescents begin to limit their choice of work, at the age of 18-21 years when adolescents narrow their choices and direct their behavior according to their needs, and at the age of 22-24 years when they begin to commit to a particular field though still influenced by what work experience will be obtained(Izzawati & Lisnawati, 2015).Career exploration is one aspect of the development of human attitudes and behavior towards careers. In particular, career exploration aims to increase knowledge

and awareness of oneself and career environment so that the individual can spur career development (Purwanta, 2012).

Research Methodology

Types of research

The method used in this research is the Research and Development (R&D) method which is useful for generating and testing the effectiveness of a product (Sugiyono, 2017).

According to (Sugiyono, 2017), the stages of R&D research consist of 10 stages as follows:

a) Potential and Problems
b) Data collection
c) Product Design
d) Design Validation
e) Design Revision
f) Product Trial
g) Product Revision 1
h) Trial Usage
i) Product Revision 2
j) Mass Production

Research Stages

In this study, there are 10 stages of R&D in sub-chapter 3.1. simplified into 8 stages as shown in Figure 3.

Figure 2
Stages of Research and Development

1. **Potential and Problems**
   In this study, the first step taken by the author consisted of five parts, namely identifying the problem, formulating the problem, determining the problem boundaries, determining the research objectives and determining the benefits.
2. **Data Collection**
   The next step is to collect data and information with a quick survey and User Experience Questionnaire (UEQ) system as material for product design planning.
3. **Product Design**

The method used to build the M-Epier application design is with the Google Design Sprints Method. Meanwhile, to design the Epier game to suit user needs, the author applies the MDA (Mechanics, Dynamics and Aesthetics) Framework with the concept of gamification.

1) Android Studio

Android Studio is an Integrated Development Environment (IDE) based on Intellij IDEA created specifically for building applications that run on the Android platform.

2) GDevelop

GDevelop is an open-source and cross-platform software used to design web-based games with HTML5 and native games on Windows, Linux (Ubuntu), Android and MAC OS X.

3) **GDS Method**

GDS is a tool or framework that combines Design Thinking and Learn Startup to transform existing problems in the design into new ideas and a prototype

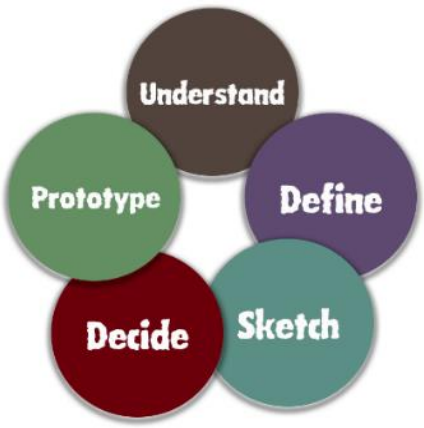

Figure *3*
Stages in Google Design Sprints Method

4. Product Trial

The product design that has been made cannot be directly tested, but needs to be made in the form of a prototype. Then, product trials were conducted to find out whether the new work system was more effective and efficient than the old system using the UEQ comparison (Sugiono, 2016).

5. Product Revision 1

For the convenience of users, the product can be repaired again if there are no changes that suit the user's needs between the old and new systems.

6. Trial Usage

If the product can be used quite well and in accordance with user needs, then black box testing is carried out on system functions to test whether the output issued based on the information entered (input) is correct (Nidhra & Dondeti, 2012).

7. **Product Revision 2**
   Improvements to the product are needed if there is an output response that does not match the condition of the command at the input when it is executed.
8. **Preparation of Reports**
   The results of the research as a whole are then compiled into a thesis writing report along with its documentation at each stage that is carried out

Results and Discussion

In this study, product design is divided into two, namely the development of M-Epier with the GDS Method and the creation of the Epier game with the MDA Framework contained in the journal "Gamification of Online Surveys: Design Process, Case Study and Evaluation". The following is a description of the design process, which consists of five main stages, namely understand, define, sketch, decide, and prototype. M-Epier is built using Android Studio software with a minimum of KitKat SDK version 4.4 (API level 19). It is built with the open-source G-Develop software. The screen resolution used is WSVGA or Wide Super VGA (1024 x 600) pixels. Object and display designs were created using Adobe Photoshop CC 2019 software. The M-Epier menu includes

- Login menu for user
- Registration menu for users
- Login menu for admin
- Forget passwords menu for users
- Questionnaire menu
- Epier Game
- Consultation menu via email
- Information menu about Epier
- User profile menu
- User data display menu for admin

1. *Understand*
   Before starting the design project, the author needs to understand the basic concepts and ideas that will be implemented into the new SICAKAR system. In addition, it is necessary to create a system flow using the User Journey Mapping method to map the activities carried out by stakeholders and the ultimate goal to be achieved.
2. *Define*
   One of the methods at this stage used by the author as the foundation of the design project is the Design Principles method which will be useful in the product development process for making reviews and making decisions. The Design Principles method applied to M-Epier consists of 4 aspects, namely as follows:

- *Effortless* : Users can work on the questionnaire career exploration easily and with fun with the Epier game feature in the Questionnaire menu.
- *Insightful* : There is thorough information in About Epier menu.
- *Attentive* : The application is easy to use and the information needed is well presented.
- *Humble* : User can receive feedback with the help of the Consultation feature.

3. *Sketch*

There are several kinds of tools that can be used to design the appearance of the application prototype, such as *Adobe XD, Origami, InVision, Zeplin,* and *Framer*. However, at this stage the author creates sketch objects and the M-Epier design display using Adobe Photoshop CC 2019.

4. *Decide*

At this stage, to decide the final goal or concept that will be developed into a prototype in the next stage, the author uses the Assumptions and Sprint Questions method to determine three important things that need to be ensured so that the solution provided can meet user needs.

- *Assumption* 1 : By adding login options for users and admins, both will understand each other's status
- *Question* 1 : Does this feature confuse users and admins?
- *Assumption* 2 : Changing the display feature of the career exploration questionnaire on the SICAKAR web into an adventure game will make it easier for users to work on the questionnaire and make them more active and excited to do it
- *Question* 2 : Is the feature boring and makes the user more passive?
- *Assumption* 3 : Eliminating the diagram feature of the questionnaire results in the User Profile menu on the SICAKAR web, then replace it in the form of images and brief explanations will provide an easier and clearer understanding
- *Question* 3 : Do users prefer the presentation of the questionnaire results in the form of diagrams?

5. *Prototype*

To implement the design that has been made and in building the M-Epier prototype, the author uses Android Studio software. The main display and the logo of the M-Epier application can be seen in Figure 6. Option menu between user and admin can be seen in Figure 2. This menu serves to distinguish user status

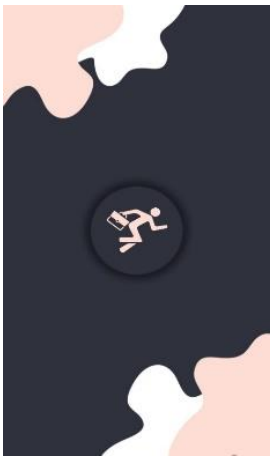

Figure 4
Welcome Activity with M-Epier Logo

Figure 5
Login Menu for User and Admin

In the admin and user login menus, there are fields to fill in the data in the form of a username and password that have been registered in the database as shown in Figure 3. If the user forgets the password, they can enter the email used for the account that has been registered as shown in Figure 4. Then, the user can check the email inbox to see the password

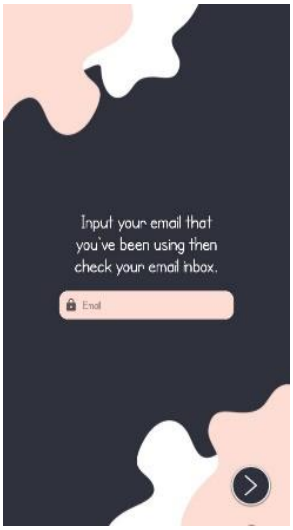

Figure 6
Forgot Password Display Menu

In the registration menu, the user is asked to enter the required data, which are name, email, password, username, class or semester, department, school or institution, date of birth and gender as shown in Figure 5 below.

Figure 7
Users Registration Menu (1)

The Epier menu has 4 (four) features, namely the questionnaire, consultation, about Epier (information about Epier), and the user profile menu as shown in Figure 6. The questionnaire menu contains questions that have been gamified into a game as well as information on other measuring tools that are still under development. The consultation menu is useful for users to send messages to psychologists via email. More information about the Epier application can be found in the about Epier menu. Users can also view their data in the user profile menu. Then, to exit the application, the user can click the shut-down button at the bottom of the menu.

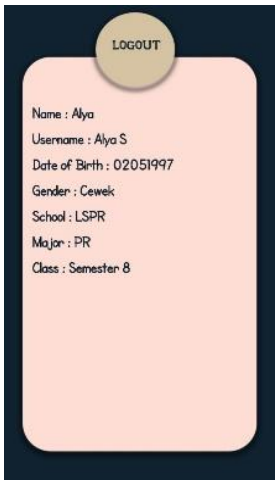

Figure 8
Menu on Home User

Figure 9
Displays the Game Hints

Figure 10
Displays The Start Of The Game

In the questionnaire menu, there is information and measuring tools for career exploration that have been gamified as shown in Figure 7. Users can conduct consultations by attaching their email and username as shown in Figure 7. This feature utilizes a database to accommodate user messages that will be sent to psychologists. The display in Figure 16 shows information about M-Epier in the About Epier menu.

Figure 11
Select Menu Based On Personality Type

Figure 1
Displays The Information On How To Use First And Second Object

MDA Application Framework

The following is an overview of the design process in the MDA Framework which consists of three layers of form design (mechanics, dynamics and aesthetics). MDA is a set of tools that can be used to design games (Sugiono, 2016), which is described as follows:

1. *Mechanics*
   Mechanics is a component of concrete rules that exist in the game. Available components are capable of performing actions defined by a particular data structure or algorithm.
2. *Dynamics*
   Dynamics can be defined as gameplay where interactions occur between the player and the system (machine) in the game. The dynamics also determine what should happen to the player as the mechanics work.
3. *Aesthetics*
   Aesthetics is a response that occurs in players after dynamics. The components in aesthetics are abstract and emotional so that each player will have a different

response to the game including sensation, fantasy, narrative, challenge, fellowship, discovery, expression, and submission.

The implementation of the 5 stages of the MDA Framework design process in the Epier game is explained as follows

1. *Game Elements for Inspiration*
   a) Making missions (quests) in the form of commands will increase the player's preparation to answer the available questions more seriously so that players feel challenged to do so. In Epier, the player is assigned to take one sea shell according to his/her personality for each question given.
   b) Creating scenarios with storylines equipped with rewards (gifts) at the end of the game will bind players to keep working on the questionnaire to completion.
   c) Adding competitive elements in the form of objects that challenge players such as barriers in the form of wood and bricks can raise enthusiasm in completing submissions.
   d) Creating a questionnaire that engages players with fun and logical questions that don't require overly tedious or complex thinking.
   e) Ensuring that each mission (quests) is neither too difficult nor too easy so that the player can complete it. This is very influential on the interest of players to complete these missions or quests because a game that is too difficult will make players feel bored and stop trying to complete it and vice versa.
   f) Increasing the use of images instead of sentences to represent an event or object.
   g) Using interactive object design by adding movement to objects during interaction between players and the system so that they are not conventional.
2. *Aesthetics and the Relationship Layer*
   a) Analyzing the targeted users to determine the aesthetics of the game guide or hint. Because the target users of the Epier game are adolescents aged 17 – 20 years, the guide is explained in everyday language that is easy to understand and is equipped with pictures or symbols to add to the aesthetic value of the design and the curiosity of players.
   b) Analyzing the targeted users to determine the aesthetics of the questions in the game. The career exploration questionnaire is targeted at adolescents. Therefore, it is necessary to use concise and clear language, be it passive or instructive sentences, and in the form of statements so that players do not think too tedious or feel bored.
   c) Analyzing the targeted users to determine the aesthetics of the answers to the game. In this case, adolescents like games that tend to be easy to follow, have a beautiful appearance and are fun to work with. Thus, to make the questionnaire to be not confusing and takes a long time, the answers are made as simple as possible. However, the answer selection process remains challenging with an attractive appearance accompanied by the addition of voices at certain events to create a sensation of beauty in the audio visual.

d) Analyzing the targeted users to determine the aesthetics of the game navigation. The form of navigation that is applied with symbols or simple sentences has more visual value for adolescents.
e) Analyzing targeted users to determine aesthetics of game missions or submissions. Giving rewards in the form of detailed results regarding the player's character in the process of understanding oneself and one's environment after completing a mission or submission will attract players' attention.

3. *Dynamics and the Conversation Layer*

Munir (2001) defines dynamics as a system that is bound, connected and mutually influencing one another. If one element of the system changes, it will have an impact on other elements. The dynamics used in a game can be in the form of player progress, player status, value (experience) obtained, lives and so on while the interaction between players and the system can be described by the use of navigation and events that occur on players and the system(Harms et al., 2015b).

The dynamics of the Epier game are as follows:

a) The application of total points determines the rewards or results that will be obtained by players.
b) The value (experience) obtained when choosing an answer can affect the total points and the final result.
c) The final result after completing all missions or submissions has a strong enough influence on the emotional state of the player.
d) Navigation used in Epier, including:
    a. "Skip" button to skip game guide or hint
    b. "Return" button to go to the previous page
    c. "Continue" button to go to the next page
    d. "Start" button to start the game
    e. Left and right buttons to move avatar
    f. Jump button for avatar to pick up the answer

4. Mechanics and the Conversation & Appearance Layers

(Harms et al., 2015b) concluded that to create an interaction with an attractive appearance, designers can create an interactive avatar mechanic so that the game has an aesthetic value. Another thing is to make an assessment mechanic in the form of experience from each question in order to implement feedback between players and the system appropriately.

5. Prototyping, Evaluation and Iteration

In general, there are three important stages in the design process before making a prototype (prototyping), namely brainstorming, ideation and sketching. It is then followed with the evaluation or repair phase by checking for errors or bugs in the system as well as errors in activities that occur when users interact with the system. After passing through these stages, the system iteration is carried out. Epier game prototyping uses GDevelop software so that developers can adjust the position of objects and displays more easily and focus on developing game design

Data Analysis

A study requires an object to determine the product design to be made, and so data collection stage is carried out. To get accurate data and information, the author used a quick survey technique.

In essence, a survey is a method of collecting data or information from groups that represent a particular population or object. The quick survey technique used by the author is purposive sampling. (Sugiyono, 2017) argues that, purposive sampling is a technique to determine the research sample with certain considerations so that the data obtained is more representative. The steps to implement it are determining whether the research objective requires certain criteria in the sample so that there is no bias, determining the criteria, determining the population based on the preliminary study and determining the minimum number of samples to be research subjects and meeting the criteria. Thus, the criteria for sampling the Epier questionnaire were determined as follows:

1. Inclusion criteria:
   - Age 17 – 20
   - High school/vocational/equivalent youth
   - Lives in Greater Jakarta
2. From 30 research subjects with the provisions above, 25 respondents met 2 of 3 inclusion criteria.

   The results of the quick survey found that most of the adolescents aged 17 to 20, both gamers and non-gamers, preferred the application of games in working on questionnaires, quizzes, surveys, or the like. In addition, adolescents prefer to be presented the questionnaires results in the form of pictures and explanations.

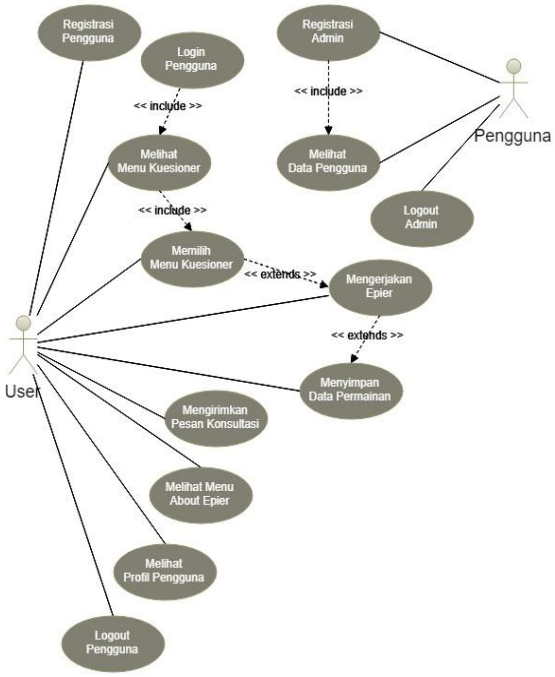

Figure 2
E-PIER Usecase

1. *Information Architecture*

The flow of data storage and transmission can be seen in Figure 37 where users access data using the internet and send their data via json before being stored into the database server.

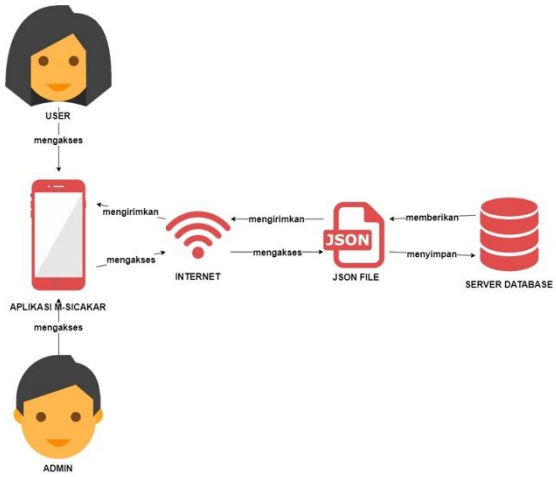

Figure 3
Information Architecture (AI) Flow

Testing

1. Product Trial and Product Revision 1

(Sugiyono, 2017) states that the product design that has been made cannot be directly tested, but needs to be made in the form of a prototype. Then, product trials are carried out to find out whether the new work system is more effective and efficient than the old system using a comparison of the results of the User Experience Questionnaire (UEQ) as in the "Measurement of User Experience" journal.

The UEQ system is a questionnaire method used to quickly and precisely measure user experience with the system. The measuring instrument is divided into six scales (aspects) with 26 items (attributes), namely attractiveness, clarity, efficiency, accuracy, stimulation and novelty.

In a previous study in 2017, testing was carried out on the system with UEQ. The results of data processing can be seen in Figures 38 and 39.

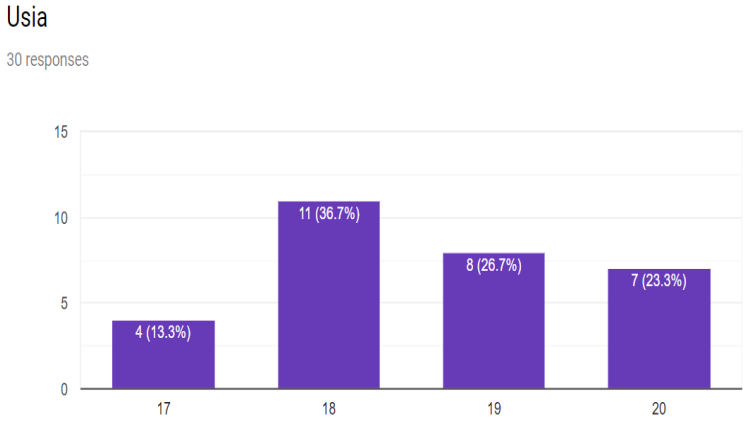

Figure 4
Ages of Respondents

The calculation results shown in Tabel I below has shown that each scale minimum has a ‘good’ value, which means the SICAKAR that has been built is of ‘good’ value.

Table 1
UEQ Results in Percentage

Scale	Mean	Perbandingan terhadap benchmark
Attractiveness **(daya tarik)**	2.34	Excellent
Perspicuity **(kejelasan)**	2.19	Excellent
Efficiency **(efisiensi)**	2.45	Excellent NT
Dependability **(ketepatan)**	1.18	Above Average
Stimulation **(stimulasi)**	2.50	Excellent
Novelty **(kebaruan)**	2.22	Excellent

Therefore, in this study, the method was re-applied with a sample of the object of data and information collection with 30 respondents aged 17-20 years who were taken randomly. The following are the results of the UEQ system questionnaire obtained.

System Planning

Epier's mobile system is designed using several tools including use cases, ERD, activity diagrams, class diagrams, flow maps, and information architecture. This is done to find out the functional requirements of the system and get an idea of the expected functionality effect so that it makes it easier for the author to design the application.

2. Use Case

Use Case serves to show the workflow of users and admins as shown in Figure 36. In the Epier application, both users and admins can login with previously registered data. Then, the user can view the questionnaire menu and work on the Epier game and save the game results. In addition, users can send messages to consult, view information about Epier, and view user profiles. Meanwhile, the admin can only see user data taken from the database

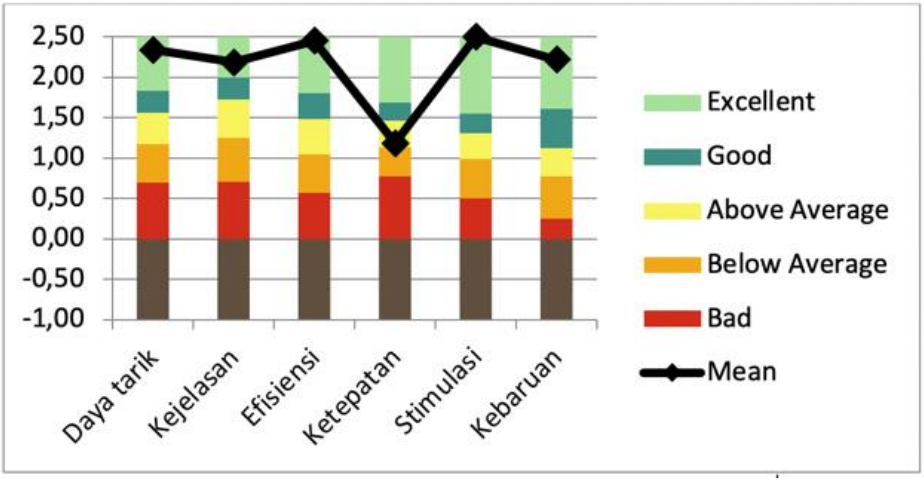

Figure 5
UEQ Results in Bar Chart Form

Based on the results of the two data and information retrieval techniques in Graphs 1 and 2, the authors conclude that although the clarity of the available information is better than average, users still do not feel comfortable when using the android version of SICAKAR both in terms of attractiveness, efficiency, clarity, stimulation and novelty. Therefore, the author tries to build an Epier application by improving its quality both in terms of appearance and system functionality to suit user needs.

4.3.2. Testing Usage and Product Revision 2

In the second test, the author uses Black Box Testing to determine the readiness of the system before it is produced or published. Black Box Testing is a test carried out to observe the results of execution on the system or application. Observation of these

results is through data testing and functional inspection of the system. This test is only used to evaluate the external appearance (interface) and its functionality in the form of input and output processes

Conclusion

Based on the application of gamification and the development of the M-Epier application that has been presented in previous chapters, the following conclusions can be drawn:

1. This research produces an Android M-Epier mobile application that can be used by high school/vocational/equivalent adolescents or for those who have just finished high school to understand their readiness and career environment in the career development process.
2. Based on the results of the tests that have been carried out, a positive value is obtained for each scale with an average value of 'excellent' (very good), which means that the appearance and functionality of M-Epier are in accordance with user needs.

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