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Gamification for Mobile-Based Al-Quran Writing Learning Applications

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ABSTRACT

Al-Quran is the holy book of Islam. Although Indonesia has the largest Muslim population in the world, children's interest in learning to write Al-Quran is still small. Whereas in the activity of writing Al-Quran there are several virtues such as being able to train accuracy, train patience and speed up the ability to read Al-Quran. This research developed an application to help people learn to write Hijayah letters (the letters used in the Al-Quran). This study uses a gamification approach in the form of score collection, leaderboard, and high score. Gamification is used to increase children's experience in learning to write Al-Quran. The results of the validation test showed that there were seven requirements resulting in a value of 100% valid. The results of the analysis from usability testing were 70.5 percent. The results of the comparison between the score from the application and the teacher (Ustadz) assessment obtained a score of 80%.

Key words: Gamification, Al-Quran, Learning Technology, Writing, Mobile Application.

1. INTRODUCTION

As a Muslims we are required to read and study and even memorize the Al-Quran every day [1]. Several ways to memorize the Al-Quran is by reciting it. Second, recite the verses of the Quran while correcting if there are mistakes. Third, write everything he will memorize on paper, then read it over and over again [2]. The method of the Quran text with specificity is that it is able to practice patience and accuracy when copying verse by verse from the Al-Quran. Supported by research conducted by Apriani, et. al. illustrates that 13-18 years old have less interest in learning to write the Quran [3]. She explained that this happened due to several factors such as the environment in which he played and the influence of gadgets.

Today's technological developments make it easier to learn read and write Al-Quran. It is proven that there are many applications such as the digital Quran to learn to recognize and write Hijayah letters. However, the application of learning is still limited to the introduction of letters and capital letters, not at the continuous writing stage [4]. The skill of writing Hijayah letters continuously is needed by someone who is learning to write the Al-Quran further or who is memorizing the Quran as previously mentioned [5]. Author wants to develop an application for further learning written in the Quran. This application will also take a gamification approach in the form of awarding points that are obtained based on the similarity of copying the verse pieces, then the points will be placed on the leaderboard. This is expected to increase user interest and motivation in learning to read and write the Quran, the gamification system itself includes elements and elements in the game [6], and uses the gamification approach, which is expected to encourage users to complete the various challenges given. on this application.

In this study, an alternative system was designed and tested to assist learning to write Al-Quran. This application was developed for mobile platforms, more specifically on the Android platform, which is expected to reach and help people learn to read and write the Quran more widely. OpenCV Library used to determine points, this library help to compare images on samples and written images that have been created by the user [7]. The points earned will be stored in the database. The accuracy of the points given by the system compared with points based on expert recommendations, in this case the expert in question is the Ustadz or recitation teacher. With this application, it will test the feasibility of a mobile application to help children learn to write Al-Quran independently using only a smartphone.

2. RESEARCH METHOD

The concept of gamification is a technique that combines the existing mindset in a game (game elements such as a scoreboard, awards, etc.) into something that is not included in the game [8]. That is, gamification requires features that make the experience of the non-game world enjoyable and addicting and use it to increase motivation and interest in certain tasks [6]. Planning and software development in this study begins by exploring user needs in the form of functional and non-functional needs using the user story technique. Furthermore, the design is carried out in two stages, namely gamification design and system design. The results of the requirements and designs obtained are then used as a

reference for developing an application.

2.1 Gamification Plan Phase

In this study, the Marczewski Gamification Framework method was used for the gamification planning process. In his journal, He explains that at the planning stage there are 4 things that underlie the gamification design [9]: 1. What is gamification (What will be a gamified system?), 2. Why will it be gamified (Why will be a gamified system?), 3 Who are the users (Who are the users of the gamified system?), and 4. How is the system gamified (How do I make the system gamified?). Table 1 shows the planning of the Marczewski's Gamification Framework.

Table 1: Marczewski's Gamification Framework Planning

No	Phase	Description
1	What is being gamified?	The system developed by applying the gamification concept is a mobile-based learning application of Al-Quran writing skills.
2	Why is being gamified?	Conventional and less attractive learning media for learning media to write Al-Quran. The need for an independent learning process anytime and anywhere without the need for guidance and assistance from the teacher.
3	Who are the users?	Users in this application are divided into two, namely guest and user. User is someone who uses the Al-Quran Writing Learning Application. Users can run all functionality on the system. Meanwhile, guests only have access to the login activity and the activity register.
4	How is it being gamified?	By applying points and the leaderboard, users will know the results of their writing are correct or not and provide more motivation to learn by using the leaderboard on the system.

Who are the user's stage was behave using the user story method. User story, which is a simple explanation of the features and functions of the system from the user's point of view [10]. Based on data from the user story, it will be analyzed to be developed into functional requirements. User stories are obtained from interviews with potential users aged 7-19 years. There are three respondents used in this study, the following are the results of interviews that have been conducted:

1. Respondents want an application that can provide guidance or assistance in writing a good and correct Al-Quran.
2. Respondents want a fun application so they don't get bored quickly in learning to write the Quran.
3. Respondents want an application that can test the correctness of the writing that has been made.

Based on the results of user stories, user identification and an overview of the features that will be designed in an Android-based mobile Al-Quran writing learning application are obtained. Users in this application are divided into two, namely guests and users. An actor describes someone who will interact in the system. Actors can only enter and receive information from the system [11]. In this study the actors are described in Table 2.

Table 2: User Identification

No	Actor	Description
1	Guest	The guest only has access to the activity login and activity register
2	User	Users can access all functionality in the system.

2.2. Gamification Design Phase

The next stage is the design development stage, at this stage will determine motivation, feedback and game mechanics, user journey, and engagement loop or feedback. Motivation is used to determine the type of user on a gamified system. Feedback and game mechanics are used to analyze the mechanics of the game and its components. The user journey is used to understand the product or application from the user's point of view, while the engagement or feedback loop is used to evaluate the results of a design that has been tested to the user. Table 3 shows the design of the Marczewski Gamification Framework.

Table 3: Marczewski's Gamification Framework Design

No	Phase	Description
1	User types	Archiver is the user type for this application user. The goal of this type of player is to learn to gain knowledge and ability to learn to write the Quran. Archivers must pass all levels/ challenges in order to upgrade and complete applications.
2	Game mechanics	In this gamification learning application, it will involve 3 game mechanics from 5 game mechanics on Achiever player types, namely achievements/rewards, levels/progression, & quests/challenges.
3	User journey	The user journey is used to describe the interaction between the user and the product/ application being developed. With the user journey, researchers can find out the possibilities that prospective users will do later.
4	Engagement/ feedback loops	By using feedback loops from users, the author can find out the shortcomings and weaknesses of the product/ application being developed. To get user feedback results, it is necessary to establish good engagement with users.

In this gamification learning application, it will involve 3 from 5 game mechanics on Achiever player types, namely levels/ progression, quests/ challenges, and achievements/ rewards.

1. Levels/Progression

The determination of the level of gamification is based on the increasing difficulty level of writing the Quran which refers to the Iqro book. There are several lessons in the application that must be completed by the Archiver in order, where each lesson has several questions that must be done by the Archiver.

2. Quest/Challenges

The challenge starts from lesson 1. In lesson 1 there are five questions that must be solved, after successfully completing all the questions in lesson 1 will continue to lesson 2. In lesson 2 there are also questions that must be solved to continue to the next lesson. If students cannot complete Lesson 1, they cannot go to Lesson 2 and beyond.

3. Achievements/rewards

After solving the questions, students will get a score that can be seen and accumulated by the system, so that the total score of all the lessons and questions that have been worked on can be discovered. Students can also see a list of other people's scores on the high score feature and can compare them to the total score achieved by the Archiver.

2.3. Game Rules and Game Play

1. Game Rules

A game has a system in which the players engage in an artificial "conflict" defined by rules that results in something measurable [12]. The rules in the game are important because they determine the mechanics of the game, but not the game itself. The point is the rules for determining win and lose. These rules are the rules of the game. In the application to be developed, there are rules that can be executed by the user. The rule mechanism is described in Figure 1.

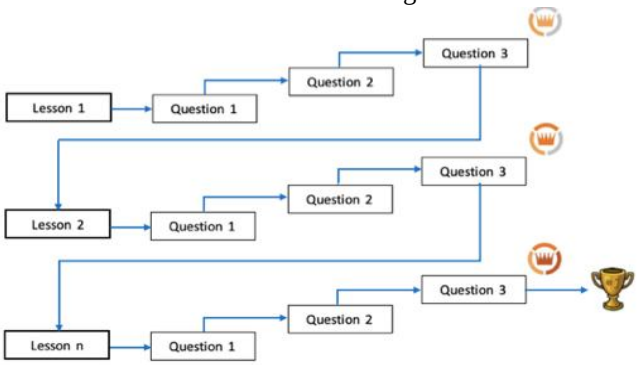

Figure 1: Game Rules Level (lessons & questions)

2. Game Play

After designing the game rules, the next step is designing the gameplay. Playing games is a game play system [13], where students are players in the gamification application of learning to write Al-Quran. The gameplay in the application is depicted in Figure 2.

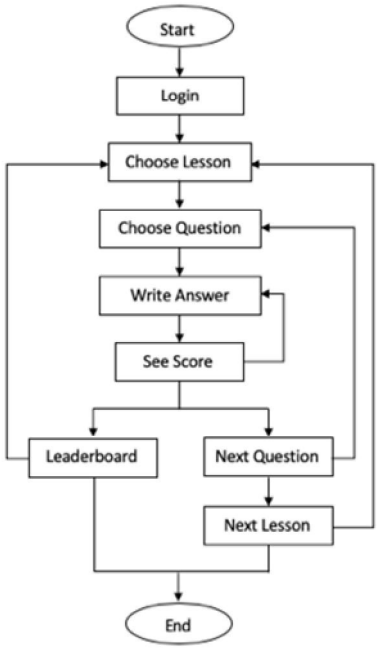

Figure 2: Game Play of System

2.4. System Design

The CRC card design and the screen flow system design have been carried out. Apart from these two designs, class diagrams and sequence diagrams are also designed. Then component design, database design in the form of ERD (Entity Relationship Diagram), and interface design.

1. CRC Cards

Class, Responsibilities, and Collaboration Cards (CRC) card is a brainstorming tool used in software development during the design or design phase. CRC cards are useful for describing classes and their functions as well as the class's relationships with other classes [14]. In this study, there are two classes. The first is the User class and the corresponding class is the class with high scores. Table 4 shown the information on the user-class CRC cards.

Table 4: User's CRC cards

User	
Responsibilities	**Collaborator**
Register a new account	
Login	
Update username and status	
See high score	*Highscore*
Doing lesson	*Lessons*
Display the leaderboard	*Leaderboard*

For information related to CRC cards on the high score feature, refer to *Highscore* class in Table 5. In order to see the high score, need a collaborator user class to display the high score or the highest score of users who use this application.

Table 5: Highscore's CRC cards

Highscore	
Responsibilities	**Collaborator**
See high score	*Lessons*

In the Lessons class there are three responsibilities, the first displays a list of questions or a list of questions that have been provided, then the second displays the total score that requires collaborators from the question class to be able to display the total score for the lesson. The third responsibility is to choose questions. Table 6. describes the class lessons.

Table 6: Lesson's CRC cards

Lesson	
Responsibilities	**Collaborator**
Displays a list of questions	
Display the total score for each question	*Question*
Choose question	*Question*

The Question class has three responsibilities, namely to present a challenge. Where this challenge must be completed by the user, and when the user completes the challenge the user will get a score. As well as displaying the score per question. An explanation of the CRC card questions is given in Table 7.

Table 7: Question's CRC cards

Question	
Responsibilities	**Collaborator**
Display a list of challenges	
Work on/complete challenges	*Question*
Displays the score per question	*Lessons*

The Leaderboard class has only one responsibility, which is to display the leaderboard. To display this class leaderboard requires collaborators from other classes, namely users. Table 8. describes the CRC card leaderboard.

Table 8: Leaderboard's CRC cards

Leaderboard	
Responsibilities	**Collaborator**
Showing leaderboard	*User*

In the History class, it is the score data that has been obtained by the user and stored in the database. Having a collaborator is a lesson to display scores. An explanation of the history of the CRC card can be seen in Table 9.

Table 9: History's CRC cards

History	
Responsibilities	**Collaborator**
See history score	*Lessons*

2. User Flow

User flow are the steps that a user must go through in using the features in an application [15]. A simple and easy user flow for users, will improve the user experience in using an application or system. Figure 3 illustrates the flow that must be followed by users in using the application.

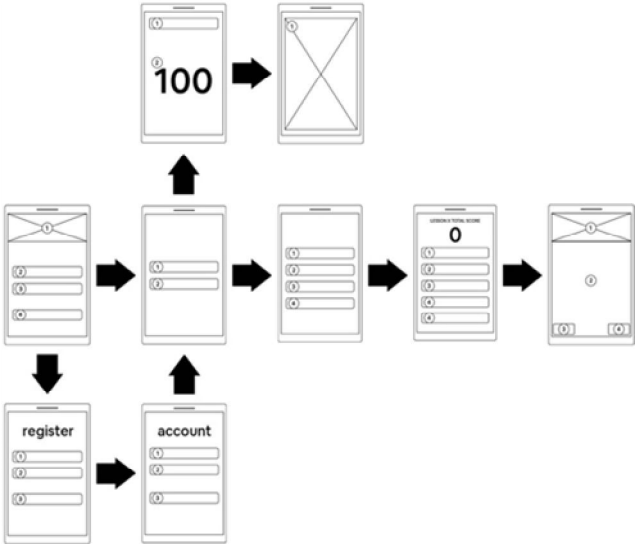

Figure 3: User flow system

3. RESULT AND DISCUSSION

The application of the mobile application for learning Al-Quran writing skills can be divided into several sequences of use. Figure 4. shows the main application page when the user has logged in to the system. Before choosing a question, the user must select the lesson to be carried out, then after finishing selecting, an option appears to select the question. Following selecting the question, users can write it according to the example provided by the system. Then the system will display the results of the user's writing. Figure 5.is the result of implementing the pages of the Al-Quran writing on the application canvas. User can write in the provided area. The "OK" button is pressed when the user is sure what it is doing, and the "X" button is pressed if the user wants to erase the entire canvas area. After the user writes the Al-Quran text and presses the "OK" button, the application will display the writing assessment results and direct it to the next question page.

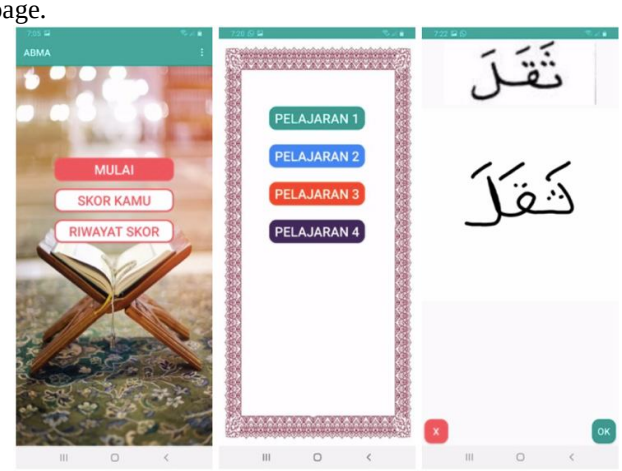

Figure 4: Main application

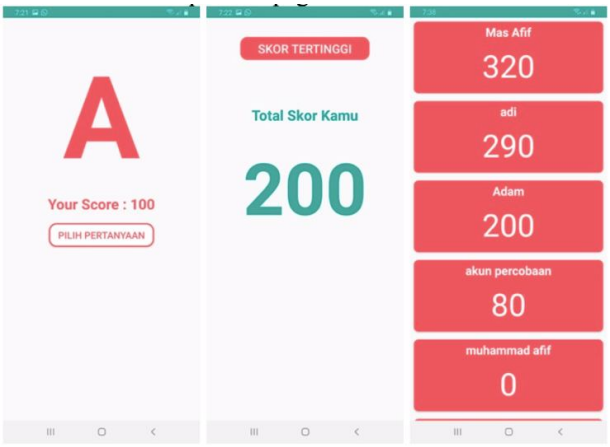

Figure 5: Score from the application

Initial testing of this application aims to see the extent to which the concept can be accepted by users. In this case the parameters used are functional testing, which aim to check whether the functionality contained in the system is as expected. The results of this test can be used as a measure of successful implementation. Table 10 shows the results of the functional testing of the Al-Quran writing learning application. Based on the results of functional testing, it was found that all functions/ features can run well as expected with 100% valid.

Table 10: Functional testing result

No	Test Case	Result
1	Login	Valid
2	Register	Valid
3	Work on challenge	Valid
4	See high score	Valid
5	See leaderboard	Valid
6	Update data	Valid
7	See score	Valid
8	See history	Valid
9	Logout	Valid

Hereinafter is testing the accuracy of the system, this test was carried out to determine the level of conformity between the results (scores) of the output of the system and the expert's assessment, in this study the expert is a teacher (Ustadz) who is accustomed to teaching the Quran to children. To compare Ustadz's scores, 10 example texts from the system are given and their writings will be assessed. In the assessment there will be a range value which can be seen in table 11. The range value used is taken from the value contained in the TPQ (Al-Quran Learning School).

Table 11: Score range

Range	Score
1. 85 – 100	A
2. 70 – 84	B
3. 50 – 69	C
4. 25 – 49	D
5. 0 – 24	E

In the comparison between the results of the application score and the assessment of the Ustadz, two different results were obtained from the 10 writings given. The application value shows a score of 80 (B), while the assessment from Ustadz shows a score of 90 (A), and the application shows a score of 80 (B), while the assessment from Ustadz shows a score of 85 (A). For the other eight scores, there is a difference in the distance between the application score and the Ustadz's assessment, which is different in the range of two to five points, and is still in the same range of scores as the set score range. Table 12 shows the results of the system accuracy test.

$$Accuracy = \frac{Correct\ answer}{Total\ answer} = \frac{8}{10} = 80\%$$

Table 12: Accuracy Testing Result

No	User Result	Application Word	Application score	Expert Score	Expert Result	Status
1	جَبَنَ	بَيَنَ	A	100	A	Valid
2	جَبَنَ	بَيَنَ	B	85	A	Invalid
3	ثَقَلَ	ثَقَلَ	A	100	A	Valid
4	كَتَمَ	كَتَمَ	B	75	B	Valid
5	وَضَعَ	وَضَعَ	C	65	C	Valid

6	ثَقَلَ	ثَقَلَ	B Your Score : 70	75	B	Valid
7	بَيَنَ	بَيَنَ	A Your Score : 90	92	A	Valid
8	هَجَمَ	هَجَمَ	B Your Score : 80	82	B	Valid
9	كَتَمَ	كَتَمَ	C	60	C	Valid
10	ثَقَلَ	ثَقَلَ	B Your Score : 80	90	A	Invalid

To determine the level of acceptance and user interest in the application being developed, usability testing was carried out. Usability testing is a test to evaluate a product by testing it directly on the user [16]. Generally, testing have been done by assigning several tasks to the user, later the user will try to complete the task. Meanwhile, researchers will observe and record all findings found during testing. There are about 10 users ranging in age from 7 years to 19 years. Testing is done by giving the application to the user, the researcher will give a task in running the application. After that, the respondent must complete the SUS testing questionnaire [17]. After completing the testing questionnaire, the results will be calculated by the researcher, the results of which will be the feasibility value of the Al-Quran Writing Learning Application.

At the implementation of the test the user will be explained how to use the application to learn to write the Quran. Then the user will be given a task to complete. For a list of tasks given to respondents. Respondents will have to work on all tasks from task number one to completion sequentially following the instructions. The list of tasks can be seen in Table 13.

Table 13: User task

No	Task
1	**Start**
2	User registers a new account
3	User fills in the name and status
4	User performs three different tasks (questions)
5	User sees the high score
6	Users view the leaderboard
7	User sees a list of score history
8	Logout
9	Login with incorrect username and password
10	Login with correct username and password
11	User update profile
12	**End**

After the user completes the task given by the researcher, the user will provide their assessment of the Al-Quran Writing Learning Application, based on the statement given by the researcher. After getting an assessment from the user, the next step is to calculate the assessment result. In the SUS method, the results obtained for the odd number result are subtracted by one (X - 1), while for the even numbers X minus the results (5 - X), after that all the values are added up and then multiplied by 2.5. The calculation results can be seen in Table 14.

Table 14: Calculation result

No	Name	Score	Result
1	Respondent 1	29	72,5
2	Respondent 2	32	80
3	Respondent 3	24	60
4	Respondent 4	25	62,5
5	Respondent 5	27	67,5
6	Respondent 6	30	75
7	Respondent 7	28	70
8	Respondent 8	28	67,5
9	Respondent 9	27	67,5
10	Respondent 10	32	80
Total Score			705
Average Score			70,5

Usability testing conducted on 10 respondents, obtained an average result of 70.5, which means that the value can fall into the "Good" category, which means that this application has been accepted and has met the needs of users in attracting interest in learning to write the Qur'an.

4. CONCLUSION

Requirements analysis stage (gamification planning) was carried out using the user story method to find out user problems. From the results of the preparation of user stories, the functional requirements of the system are explained in the identification of actors, use cases, and use case diagrams. At

the design phase, gamification fulfilled using the Marczewski's Gamification Framework method to determine the game mechanism, game rules, and gameplay of the Al-Quran writing learning application. At the system design stage, data design was implemented using CRC cards and the screen flow method of the application which is used as the basis for creating a complete system flow and display. The OpenCV library used to compare images between images in the application and user writing.

The test results on the system were carried out by functional testing and accuracy testing, the following results were obtained:

a. Functionality testing used to test the features of the entire system, displaying the results of all functions that are running as expected by getting a 100% valid value.

b. Accuracy testing have been done by comparing the score on the application with Ustadz's assessment. Of the 10 tests, it was found that eight writings had the same value range between the system output results and the Ustadz's assessment, and two writings had different value ranges. The system accuracy value is 80%.

c. Usability testing conducted on 10 respondents, obtained an average result of 70.5, which means the value can fall into the "Good" category, which means that this application has been accepted and has met the needs of users in attracting interest in learning to write the Qur'an.

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