

Gamified Distance Learning Application Design for Enhanced Student Engagement and User Experience

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Abstrak. *Desain Gamifikasi Aplikasi Pembelajaran Jarak Jauh untuk Meningkatkan Keterlibatan Siswa dan Pengalaman Pengguna.* Pembelajaran Jarak Jauh di Indonesia merupakan salah satu metode pembelajaran yang mulai diterapkan pada masa pandemi Covid-19. Namun pada penerapannya siswa menghadapi beberapa kendala seperti kurangnya motivasi, kesulitan dalam mengoperasikan perangkat pembelajaran, kesulitan mempertahankan fokus, dan keterlibatan siswa selama proses pembelajaran. Gamifikasi menawarkan solusi untuk masalah ini dengan meningkatkan motivasi dan keterlibatan pengguna, seperti yang telah terbukti dalam penelitian dapat memberikan dampak tersebut. Oleh karena itu, penelitian ini bertujuan untuk merancang aplikasi mobile Pembelajaran Jarak Jauh dengan menerapkan gamifikasi. Penelitian ini menggunakan data kualitatif dan kuantitatif, termasuk tanggapan 32 siswa dari kuesioner seperti UEQ-S, yang digunakan untuk menguji antarmuka pengguna, dan UES-SF, yang digunakan untuk menguji elemen gamifikasi. Penerapan gamifikasi pada desain ini memperoleh skor pengujian untuk aspek engagement sebesar 83% dan hasil UEQ-S secara keseluruhan sebesar 1,89 yang termasuk dalam kategori Sangat Baik.

Kata Kunci: pembelajaran jarak jauh, gamifikasi, User Experience Questionnaire, User Engagement Scale

Abstract. *Distance Learning in Indonesia is one of the learning methods that began to be applied during the Covid-19 pandemic. Yet students face some obstacles, such as lack of motivation, struggling with operating learning devices, difficulty maintaining focus, and student engagement during the learning process. Gamification offers a solution to these problems by significantly enhancing user motivation and engagement, as it has been tested in research to have a profound impact. Therefore, this study aims to design a mobile application for Distance Learning by implementing gamification. It employs qualitative and quantitative data, including 32 students' responses from questionnaires like UEQ-S, utilized for testing user interface, and UES-SF, employed for testing gamification elements. By implementing gamification in this design, an engagement score of 83% was obtained, and the overall UEQ-S result was 1.89 in the Excellent category.*

Keywords: distance learning, gamification, User Experience Questionnaire, User Engagement Scale

1. Introduction

Covid-19 is a viral disease that attacks the human respiratory system and is contagious. Covid-19 is expected to appear at the end of 2019. It didn't take long for this virus to spread to various countries. Officially Covid-19 was declared a pandemic by the World Health Organization (WHO) on January 5, 2020. The Covid-19 outbreak was first detected in Indonesia on March 2, 2020 [1]. Because this epidemic is easily transmitted, the government has implemented regulations to maintain distance from one another [2]. The government also calls for work to be done from home or Work From Home (WFH). This certainly has an impact on many fields, ranging from the economy, and tourism to education.

Due to the implementation of WFH and to prevent crowds from forming, education in Indonesia must also adapt to this policy. In the educational aspect, the impact of this pandemic has forced students to study both independently and remotely. Officially the government banned

face-to-face learning activities at all levels of education and replaced them with Distance Learning on March 26, 2020 [3]. Education in Indonesia, which was originally carried out face-to-face, has been replaced by online education. Online learning is carried out using applications and using social media.

The quick switch to alternative pedagogies hurt Indonesian education. Poor education is one of these repercussions. Three types of quality decline are facilities, faculty, and students. Limited facilities, like not every student having a computer, cause problems. The uneven distribution of internet connections in Indonesia is another issue [4]. An obstacle that educators and learners encounter is the arduousness associated with acclimating to a novel system, encompassing its operation and user interface. Additionally, modifications to learning plans in order to accommodate the circumstances of distance learning contribute to the deterioration of student education. A lack of motivation to participate in the learning process and the challenge of accessing and comprehending online learning materials all contribute to this decline [5]. The decline in the quality of learning also affects the effectiveness of learning. The effectiveness of distance learning methods is considered not as effective as offline learning.

Despite the past time of the Covid pandemic, education still needs to be integrated between conventional ways and ways that involve technology in learning. This can be done by combining several learning methods or by using a new learning method. Some research findings suggest that distance learning can still be applied post-pandemic, one of which is by combining offline and online learning into blended learning [6]. Besides, educational institutions need to create a new post-pandemic learning method to be able to compete and be relevant to the character of their students.

1.1. Specific Purpose

Some of the problems that arise in the field of education can be corrected by applying the gamification method. Gamification has many impacts, including increasing motivation and increasing user involvement in the thing being gamified. This research plan to develop an online learning application using gamification methods to enhance learning effectiveness and student motivation, addressing the challenges in the field of education, particularly in distance learning and the impact of gamification. Furthermore, this research also aims to make the application interface more user-friendly by employing several stages of testing.

To achieve the research goals, two test scenarios are conducted: a design test scenario and a gamification testing scenario. The design test script is derived from the User Centered Design (UCD) methodology, wherein the research encompasses UCD stages including user requirement analysis, design development, and testing. The User Experience Questionnaire (UEQ) computation method is employed in the testing part. This design scenario is employed to generate designs that are easy for users to navigate and interact with. The second test is conducted to evaluate the efficacy of implementing gamification. This test employs the User Engagement Score (USE) methodology. This test involves the computation of engagement scores, which might reflect the impact of gamification, specifically the appeal and involvement of the user.

1.2. Gamification

Gamification is the use of game elements in an activity or a context that doesn't have game elements in it [7]. Initially, this concept was used for industrial purposes. Still, since this concept was introduced through research and conferences, gamification has also begun to be used in various fields, such as education [8]. Gamification is widely used in various fields due to its positive effects. This effect arises due to the use of existing elements in the design of a game [9]. Some examples of game elements in gamification are points, task, rewards, badge, level, and leaderboard [10].

The application of gamification in the field of education has led to several new terms, such as serious games, game-based learning, and others [11]. The benefits of learning using this method can be divided into two: the benefits for educators and the benefits for students. For students, the benefits of gamification include increasing learning motivation and providing a focus

on goals during the learning process [12]. While the benefits for educators are to increase the attractive class atmosphere, improve evaluation and communication, and enhance the relationship between educators and students [13].

The aspect of gamification in the field of education is tailored to meet its specific requirements. For instance, the point element serves as a metric for evaluating user performance and can also function as incentives for the user. Levels are utilized to signify the degree of proficiency in user concepts. Leaderboards facilitate user competition by enabling comparisons between individual users [14].

Although in various studies, gamification has been proven to have a positive impact, there are also research results that state that gamification does not have the maximum effect [15]. This can happen due to the lack of application of the gamification component in the intended context. The application of gamification needs to consider the use of its elements so that it can have a balanced effect on intrinsic motivation and extrinsic motivation.

Intrinsic motivation is the motivation that arises due to doing something exciting or fun [16]. This motivation is autonomous, which means that actions are taken because this motivation comes from self-will that is triggered by pleasure and interest in certain things [17]. There is a concept that can be used to increase this intrinsic motivation, and the idea is Self-Determination Theory (SDT). Three factors can psychologically affect intrinsic motivation: autonomy, competence, and relatedness. Autonomy is influenced by the actions carried out by the individual, which come from his own will. Competence can be affected by feelings of being able to do a task at a certain level. Relatedness is affected by actions that involve associations with other people [18]. These three factors are essential and need to be applied to the gamification design that will be created.

Extrinsic motivation arises because an award, such as prizes, grades, and praise, drives it [19]. Extrinsic motivation has a role in encouraging users who lack interest in the things to be gamified [20]. Gamification elements that can trigger extrinsic motivation include rewards, points, and leaderboards [21].

1.3. User Engagement Scale

There are different ways to figure out what effect gaming has on a situation. The User Engagement Scale (UES) is one way to do this. It was O'Brien and Toms who first found the UES method while looking for a good way to measure user interest or activity. There are two kinds of UES: the long (old) version and the short (new) version. This is because studies question the six main factors in the old form of UES: novelty, usability, engagement, and durability. These factors are perceived usability, felt involvement, and aesthetic appeal [22]. In response to these problems, the UES was remade, and the main factors, which previously numbered six factors, were revised into four elements (aesthetic appeal, reward, focused attention, and perceived usability) [23]. In addition to the number of main factors, the number of question items to users was also revised from the previous 31 questions to only 12. Table 1 is a list of question items for UES-SF.

Table 1. UES-SF Items

Code	Questions
FA-S.1	I got lost in this experience
FA-S.2	The duration of time I allocated to utilizing this application effortlessly passed by
FA-S.3	This application experience had me completely engrossed
PU-S.1	I experienced a sense of frustration while utilizing this application
PU-S.2	I found the usability of this application to be perplexing
PU-S.3	Utilizing this application was arduous
AE-S.1	This application was visually appealing
AE-S.2	This application had a visually pleasing design
AE-S.3	This application was aesthetically pleasing to me
RW-S.1	The utilization of this application proved to be valuable
RW-S.2	I found my experience to be fulfilling
RW-S.3	I was intrigued by this experience

The procedure for utilizing the UES-SF is quite straightforward: one must complete a questionnaire consisting of a series of UES-SF inquiries and respond to them using a Likert scale ranging from 1 to 5, where a score of one indicates a lack of strong disagreement. A rating of five indicates a high agreement, with the requirement that negative comments must be rephrased as positive words. The results of the questionnaire will then be calculated by means/rules, (1) If there are participants who engage in the survey multiple times, their scores should be segregated and regarded as iterations or comparisons with their earlier involvement; (2) The score for each factor is determined by summing the scores of the three-factor items and then dividing by three; (3) The engagement score is calculated by summing all the elements and then dividing by twelve [23]. This method was chosen because there are clear guidelines for its use and comprehensive discussion on improving user experience and engagement. In addition, this approach is also widely used in game contexts [24] and gamification [25].

1.4. User Experience Questionnaire

User Experience (UX) is an essential factor in the success of a particular design, product, or service. This is because a good design that is easy to use does not confuse users and is an aspect that can be measured by conducting research related to UX [26]. UX can be measured using several methods. Commonly used methods include AttrakDiff, UEQ, and mCUE. This research will use the short version of the UEQ method or UEQ-S. This method provides a complete guide and has been translated into various languages, making it easier to understand. In addition, UEQ-S also provides tools that can be used to process data from the questionnaire results, making it easier to use. This method uses a list of questionnaire questions, which total eight questions [27], and respondents answered using the Likert scale method with a scale of 1 to 7 [28].

2. Literature Review

Research related to gamification in the field of education is still being carried out by using existing applications. Many previous studies have examined and researched the impact of gamification on education and obtained favorable results. However, the design of a distance learning application that applies the concept of gamification in Indonesian education is still rare.

Gamification studies using existing applications, such as Kahoot and Quizizz, have been conducted in this pandemic era [29]. Gamification is used in many research projects to make learning more interactive and enjoyable by creating questions or quizzes. This program can only be used to deliver learning questions or quizzes, limiting the gamification effect.

Video-based learning and gamification are also used in LMS research. This study creates basic animated films, video lessons, and podcasts to make learning more interactive. Gamification elements, including badges, game-level achievement, and feedback, are also included. According to this study, video-based learning and gamification in a Learning Management System (LMS) can increase student engagement [30].

There is a study that deals with remote learning using social media. The results of this study show that this method is only effective for learning that contains a lot of theory. This leads to a decline in understanding and lowering the student's grades [31].

Gamification is also applied to story-based learning, such as history or folklore. This type of gamification emphasizes using avatar gamification elements, and some animations can be used to illustrate existing stories [32]. Gamification can also improve the quality of delivering material to students, for example, in subjects that are difficult to understand for some students, such as mathematics [33] and some other science subjects.

Assignments within the learning process can also be subjected to gamification. Legaki ran an experiment comparing traditional learning with gamification. The implementation of gamification components such as points, levels, challenges, and leaderboards led to improved outcomes in gamification learning [14].

This project aims to develop a mobile application prototype for distance learning, using the concept of gamification. Additionally, the prototype will undergo user experience (UX) testing. The concept of gamification in the design of this program extends beyond simply

providing questions or quizzes, including the entire learning process. Due to its potential for maximum gamification and sustainable impact, this application design can be utilized and integrated not just during the epidemic age but also for future learning purposes. This research differs from prior studies in that it specifically focuses on enhancing the design of the application to improve usability and aesthetic appeal. Furthermore, this study incorporates gamification components with the objective of enhancing student engagement in the remote learning procedure.

3. Research Methodology

There are several stages carried out in this research method from the beginning to the end of this research. The research flow can be seen in Figure 1.

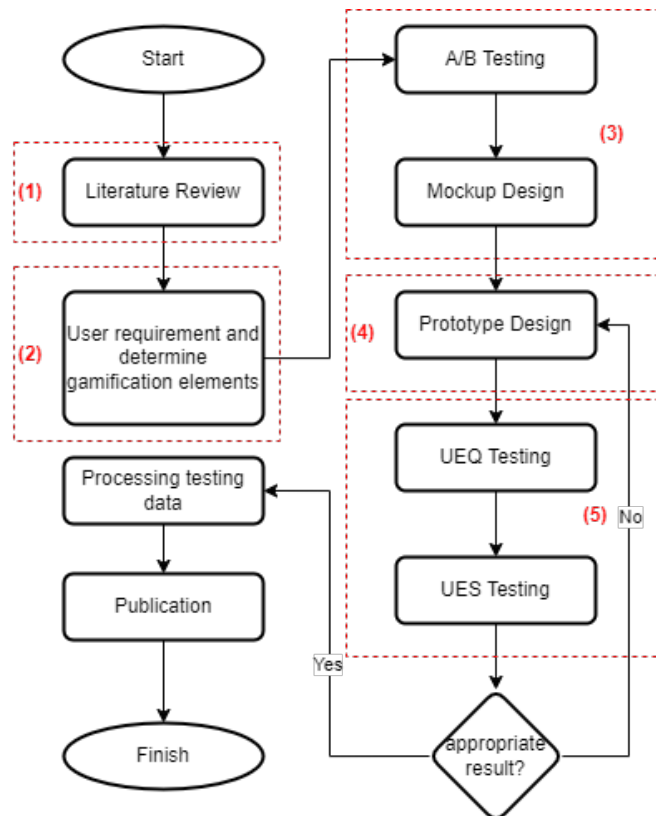


Figure 1. Research Flow Diagram

Figure 1 shows five research stages: (1) data gathering is done by doing a literature study, searching for data in relevant journals and publications. The literature was searched on Google Scholar and Scopus. Gamification, user engagement scale method, user experience questionnaire, and remote learning were searched for in this literature. Next, numerous students are interviewed for system requirements analysis. The goal of this interview was to learn about remote learning application basics. Interviews were used to understand user demands. The interview results can also be used to establish gamification features for this design.

Perform (3) User Experience Analysis. A/B testing is utilized for UX research at this level. This strategy gets student- and professor-friendly application features. A/B testing also helps categorize application menu components. The respondent receives two design views from the proposed application menu for the exam. Respondents will judge which design is better/easier. Using the respondents' responses, this application's prototype will be designed.

Designing a prototype follows feature data collection. A prototype application that interacts like a genuine app is used to design. Five prototypes are tested to check if the design looks good and is easy to use. Used the User Experience Questionnaire-Short Form to test this

prototype. This application's gamification concept was also tested. This will test whether adding gamification to this app has the desired effect. Gamification testing uses the User Engagement Scale questionnaire, which is processed for results.

Gamification's influence can be measured in many ways. One method is the User Engagement Scale (UES). O'Brien and Toms discovered the UES approach while seeking for a mechanism to evaluate user involvement. UES includes full/old and short/new versions. This is because studies dispute the six primary characteristics (aesthetic appeal, focused attention, novelty, perceived usability, emotional engagement, and endurability) in the original UES.

4. Results and Discussion

This research uses several methods, such as A/B testing, making application prototypes, UEQ testing, and UES testing. The following is an explanation of each stage carried out.

4.1. A/B Testing Result

A/B Testing of this research mockup was conducted on 15 respondents. The respondents were selected from students who have experience with both online and offline learning in order to provide a more accurate assessment of their specific functional requirements. The A/B Testing is conducted by executing type A and type B prototypes within the Figma application. The purpose of this is to enable respondents to efficiently assess the offered mockup directly on their own devices. Figure 2 and Figure 3 display visual representations of the distinctions between designs A and B.

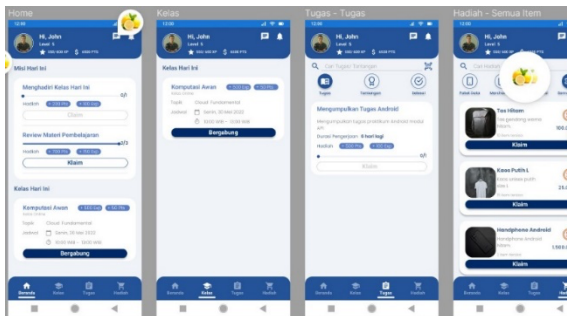


Figure 2. Mockup A

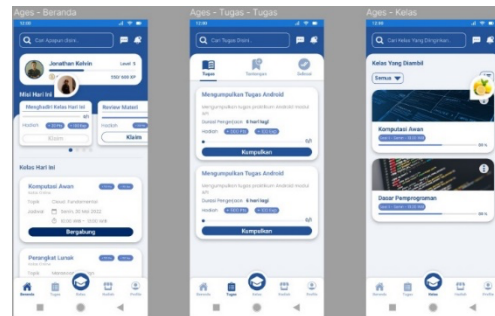


Figure 3. Mockup B

From the test results, respondents tend to choose mockup B as a design that is easier to understand and more comfortable to use. Therefore, design B is a design that will later become a benchmark for other menu designs and sub-menus of this mockup.

4.2. Mockup Design

Mockup B was refined and expanded to incorporate more features based on the findings from A/B testing. The mockup consists of five primary menus: homepage, assignments, class, prizes, and profile. The home menu is a display that shows information about the progress of levels, points, ongoing challenges/tasks, and the lessons scheduled for the day. The home menu incorporates gamification aspects such as progress bars, attributes, levels, awards, and tasks/challenges. Users can get more detailed information about assignments and classes through a different menu called the selection and class menu. The award menu is a frequently used use of gamification. This menu displays the cumulative number of points gained, which may then be redeemed for prizes within each respective category. Additional gamification components implemented in this prototype consist of badges and awards, which may be found via the Profile menu. Figure 4 displays several images of the finished mockup.

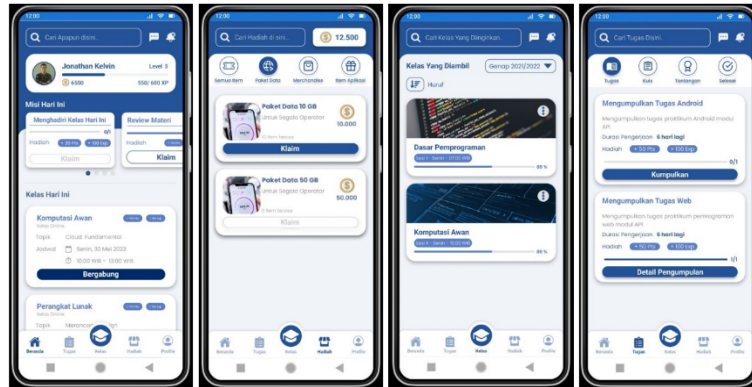


Figure 4. Final Mockup

4.3. Prototype Design

After the mockup has been made, the following research stage is to make a prototype. Prototypes are made by connecting mockups to produce the desired workflow. After the prototype has been successfully created, the following process tests several respondents.

4.4. Prototype Testing with UEQ and UES

At this stage, 32 respondents tested the prototype. The background tester is a student/student who has received lectures online dan offline. Each tester is given time to try the prototype results first and is given several test scenarios, such as how to redeem rewards in this application. After that, the tester will be given a questionnaire containing questions for UEQ and UES data. After the data from the questionnaire results were processed in the UEQ analytics tools, the average results were obtained, as shown in Figure 5.

Item	Mean	Variance	Std. Dev.	No.	Negative	Positive	Scale
1	2,2	0,5	0,7	32	obstructive	supportive	Pragmatic Quality
2	2,2	1,0	1,0	32	complicated	easy	Pragmatic Quality
3	2,1	0,6	0,8	32	inefficient	efficient	Pragmatic Quality
4	1,3	4,7	2,2	32	confusing	clear	Pragmatic Quality
5	1,8	1,0	1,0	32	boring	exciting	Hedonic Quality
6	2,1	1,3	1,1	32	not interesting	interesting	Hedonic Quality
7	2,1	1,6	1,3	32	conventional	inventive	Hedonic Quality
8	1,5	1,9	1,4	32	usual	leading edge	Hedonic Quality

Figure 5. UEQ Mean Result

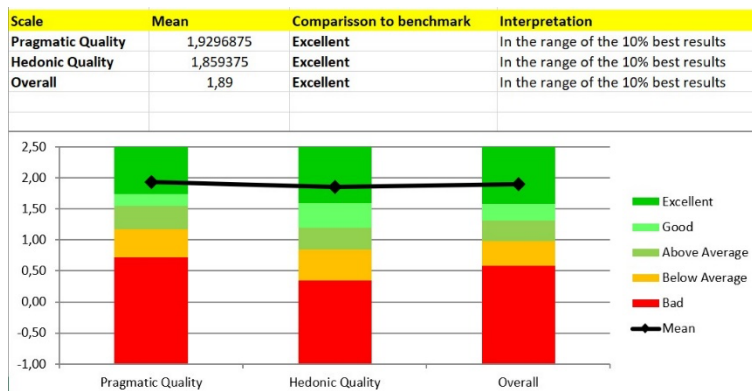


Figure 6. Overall Result

Based on data in Figure 6, the eight questions (items) are divided into two scales: pragmatic quality and hedonic quality. Pragmatic quality describes results that are Perspicuity, Efficiency, and Dependability, while hedonic quality is defined by results that are Stimulation

and Novelty. Overall the average value of each item can be said to be good because it is not harmful. In addition, previous research stated that if the pragmatic quality is improving, then the design that has been made can be said to be good too [34]. In this study, the practical quality value was 1.93/2.5, and the hedonic quality value was 1.86/2.5. Overall the results of this design get a value of 1.89 with Excellent status. The overall data processing results from this study can be seen in Figure 6.

In addition to testing the user experience aspect, this design was also sampled from the view of its gamification application. The UES test gives respondents 12 questions related to engagement with the designs that have been tried. Questions and question codes can be seen in Table 2. Figure 7 is the average of each engagement factor.

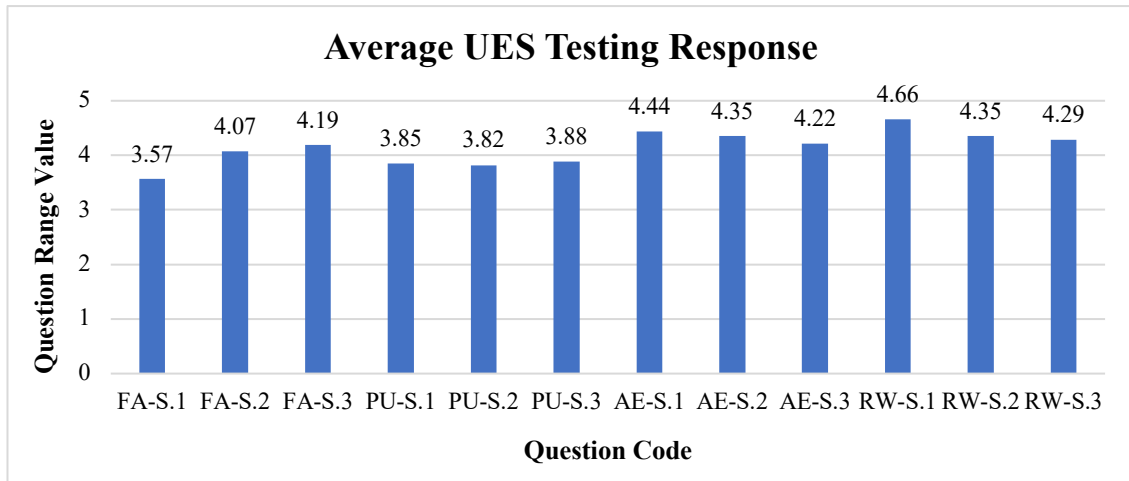


Figure 7. Average UES Testing Response

In Figure 7, it can be seen that the results of the Perceived Usefulness (PU-S) factor produce an average value of 3.83, so it can be said to be good. This is important because one of the factors that can affect the performance of online/mobile learning is Perceived Usefulness [35]. In addition to the average results of each factor, the engagement score for this design is 4.14 or 83%. This score is obtained by adding all the items from all responses and then dividing them by 12 question items. From the results obtained of 83%, it can be said that gamification in this distance learning application's design can increase interest, engagement and motivate users.

5. Conclusion

This study aims to create a mobile application design for distance learning using the concept of gamification to increase student motivation and involvement in learning. Several gamification elements are implemented into this design, such as rewards, points, achievements, progress bars, and challenges/tasks. This gamification element is then tested using the User Engagement Scale-Short Form (UES-SF) method to determine its impact. In addition, testing of the User Experience and User Interface of this design is also implemented so users can more easily operate the User Experience Questionnaire-Short Form (UEQ-S) method. The test results conducted on 32 respondents showed an 83% engagement score from the UES test and an overall score of 1.89, which was included in the Excellent category from the UEQ test. Based on the test results, it can be said that this application design can increase student motivation and involvement and has a user-friendly application interface.

With convenience and increased student interest, it is hoped that in the long term, students will gain increased achievement and change a positive perspective on learning. Given the enhanced comfort and heightened attention of students, it is anticipated that over time, students will experience enhanced academic achievement and undergo a transformation in their positive

perception of learning. These results suggest that future studies should focus on investigating the long-term effects and modifications in learning outcomes.

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