

Performance Improvement and User Satisfaction Analysis on Android-Based Educational Mobile Game

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Abstract—Tourism is a sector currently in the spotlight by many parties, including the government. This is because tourism attracts tourists. This tourism can drive the economy and empower the community. However, the lack of promotion from the government and the community makes tourism in Riau Province less well known. Therefore, in 2016 the educational game "Ayo Wisata ke Riau" was developed, aiming to provide education about tourism in Riau Province. However, the developed game has several problems, such as content that is not up to date and inappropriate, the size of the game is too large, and the display is not attractive. Therefore, a re-engineering process with a User Experience (UX) approach is needed to overcome these problems. After the re-engineering process, Usability testing and User Experience Questionnaires were carried out to test user satisfaction and experience using the application. Testing is done by doing pre-test and post-test. The pre-test is a test by playing games that have been developed in 2016, and a post-test is a test by playing games after the re-engineering process is carried out. Based on the results of the tests carried out, the level of user satisfaction increased by 49.7%, and the results of the evaluation of UX measurements showed positive evaluation results, which meant that users were satisfied in using the application.

Keywords—Riau Province Tourism, Educational Mobile Game, User Experience

I. INTRODUCTION

Nowadays, technology was developed very rapidly and cannot be avoided. Technology development plays an essential role in human life because technology makes it easier for humans to carry out daily activities. One of the positive impacts of the rapid development of technology is that it is easier for people to get the information they need to learn many new things.

The use of technology such as games as a medium of education about tourism in Riau Province is still rare. Games can be a medium to provide learning to players through games that are easy to understand. Educational themed games can provide learning to players, so players can learn new things from the games they play.

Tourism is a sector currently in the spotlight by many parties, one of which is the government. This is because tourism attracts tourists from within and outside the Riau

Province. Thus tourism can drive the economy and empower the community. However, the lack of promotion from the government and the community makes tourism in Riau Province less well known.

Febriano et al [1] have developed a mobile educational game, "Ayo Wisata ke Riau". This game aims to provide education about tourism in Riau Province to the public. The game runs on android-based mobile devices and has a 2D display. However, in the game, several problems cause user satisfaction in using the application to be only 82.49%.

Problems that arise starting from the size of the game that is too large, the display is less attractive, and the content is not up to date. Therefore it is necessary to re-fix the game. The problems that arise in the game will be discussed in the Focus Group Discussion (FGD). The results of the FGD are used as a reference for the redevelopment of tourism educational mobile games in Riau Province (Kreshna et al., 2020), resulting in an optimization of application improvements based on the user's point of view (Trisnadoli et al., 2021). However, in its implementation, UX improvement and user satisfaction measurement are still not very visible.

Based on the above problems, an analysis of the performance improvement of the mobile educational game "Ayo Wisata ke Riau" was carried out. Performance improvements are carried out using an approach to the User Experience of players when using the application. It is hoped that with the performance improvements made, the level of user satisfaction can increase.

II. RESEARCH METHODOLOGY

The stages of the development of the 'Ayo Wisata ke Riau' mobile game are:

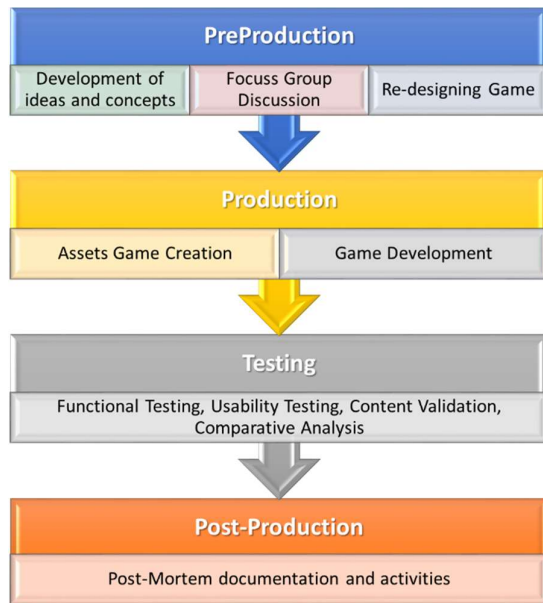


Fig. 1. Game Development Stages

There are several stages in game development, from game ideas to playable games, namely Pre-production, Production, Testing, and Post-production.

1) Pre-production

Pre-production is the stage to determine the game to be developed and project planning. This stage focuses on finding ideas, game concepts, and game development designs.

2) Production

Production is the main stage in game development. This stage implements the ideas, concepts, and game designs that have been made in the pre-production stage.

3) Testing

After the production stage is complete, the game that has been developed will be tested. Tests are carried out to ensure the game can run well, look for potential bugs, and fix bugs.

4) Post-production

Post-production is the stage for making documentation and post-mortem activities.

The testing methods used in this study are:

1) Blackbox Testing

Blackbox testing is a type of software testing on system functionality. The purpose of this test is to test each function of the game according to its function or not.

2) Content Validation

Content validation is required so that the content presented in the game corresponds to the actual situation. In this test, tourism experts are needed so that the content presented is valid. The expert who will validate the content presented in the game is the head of tourism resource development. If inappropriate content is found, a review will be carried out on the content presented. If appropriate, the test is declared valid.

3) Usability Test

Usability Test is a type of software testing conducted to measure the level of user satisfaction. Players will provide feedback by filling out the questionnaire given after playing the game that has been developed. The questionnaire uses a Likert scale and has several criteria that players will answer.

4) User Experience Questionnaire

The User Experience Questionnaire is a test that assesses user experience in using the application. Players will provide feedback by filling in the UEQ given after playing the game that has been developed. Six factors will be measured in the UEQ, namely Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty.

The research method at least describes the approach used in the study, the population, and the research sample explains the operational definition of variables along with data measurement tools or methods of collecting data and data analysis methods.

If the data measurement tool uses a questionnaire, it is necessary to include the results of the validity and reliability test of the research instrument.

III. GAME PRODUCT DEVELOPMENT RESULTS

The following image is the initial view when we run the game. There is a Play button to process the following display and a settings button for settings in the game. Players must press the play button to move to the Riau Province map page.

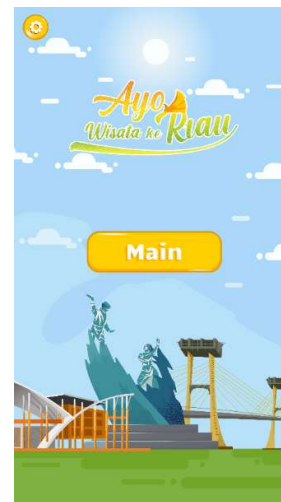


Fig. 2. Main Menu of Game Product

Fig. 2 displays the Riau Province map page that appears when the Main button is pressed. In this scene, the player can choose the area to start the game. Each selected area has a different type of game, including quiz games, guessing pictures, and puzzles. Below is a selection of games for each region in Riau Province. Regional selection is based on the district/city because the area is the main area of the Riau province

TABLE I. GAME OPTIONS OF GAMEPLAY

No.	Game Options	City / Regency
1	Questions	Pekanbaru City
		Kampar Regency
		Pelawan Regency
		Dubai City
2	Guess the picture	Rokan Hulu Regency
		Rokan Hilir Regency
		Kuantan Singingi Regency
		Siak Regency
3	Puzzle	Bengkalis Regency
		Kepulauan Meranti Regency
		Indragiri Hulu Regency
		Indragiri Hilir Regency



Fig. 3. Main Map of Riau Province as in Gameplay

Fig. 4 shows that there are three game pages as quizzes, guess pictures, and puzzles. Each player will be given ten different challenges and a playing time limit. Each completed challenge will get a score of 10 points. In each game, the player will be given the correct answer if the playing time has run out or the answer given is wrong.

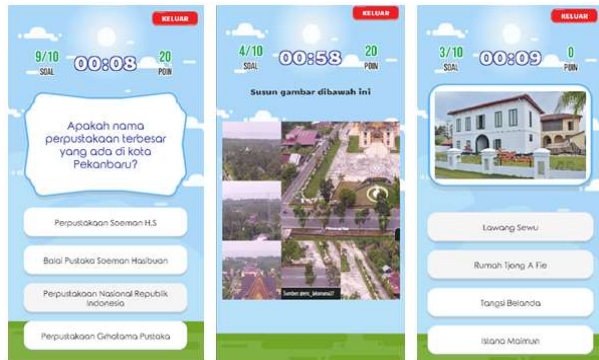


Fig. 4. Gameplay in Ayo Wisata ke Riau Mobile Game

After the game is over, the final score will appear. Players will be asked to enter a name so that the score can be saved. The saved score will be displayed on the scoreboard.



Fig. 5. Scoreboard of Game

IV. ANALYSIS OF TESTING RESULTS

A. Analysis of the results of the Black Box Test

Blackbox testing was carried out to test the functional game 'Ayo Wisata ke Riau' that had been built. Tests are carried out to check whether all game functionalities can run as expected or not. There are several test cases carried out with different scenarios to test all game functionality. The test results show that all game functionality runs according to the expected results based on the tests carried out.

TABLE II. BLACK BOX TEST RESULTS

No	Test Case	Scenario	Expected Result	Actual Result	Status
1	Fungsi menu main	Pemain membuka permainan lalu menekan tombol "Main"	Menuju ke scene peta Provinsi Riau	Menuju ke scene peta Provinsi Riau	Valid
2	Fungsi keluar permainan	Pemain menekan tombol Keluar lalu memilih "Ya"	Pemain keluar dari game	Pemain keluar dari game	Valid
		Pemain menekan tombol Keluar lalu memilih "Tidak"	Pemain tetap berada pada game	Pemain tetap berada pada game	Valid
3	Fungsi menu bantuan	Pemain menekan tombol Setting lalu memilih menu "Bantuan"	Pop-up bantuan muncul	Pop-up bantuan muncul	Valid
4	Mulai permainan	Pemain memilih Kabupaten/Kota pada peta Provinsi Riau lalu menekan "Lanjut"	Pindah ke scene permainan	Pemain masuk ke scene permainan	Valid
5	Gameplay permainan kuis	Pemain membuka halaman permainan kuis lalu menjawab soal dengan Benar	Game akan memberitahu bahwa jawaban benar dan skor bertambah	Jawaban benar dan skor bertambah	Valid
		Pemain membuka halaman permainan kuis lalu menjawab soal dengan Salah	Game akan memberitahu jawaban salah dan benar	Game memberitahu jawaban salah dan benar	Valid
		Pemain membuka halaman permainan kuis lalu tidak menjawab soal hingga waktu habis	Game akan memuat soal selanjutnya	Game memuat soal selanjutnya	Valid
6	Gameplay permainan tebak gambar	Pemain membuka halaman permainan tebak gambar lalu menebak gambar dengan Benar	Game akan memberitahu bahwa jawaban benar dan skor bertambah	Jawaban benar dan skor bertambah	Valid
		Pemain membuka halaman permainan tebak gambar lalu menebak gambar dengan Salah	Game akan memberitahu jawaban salah dan benar	Game memberitahu jawaban salah dan benar	Valid
		Pemain membuka halaman permainan tebak gambar lalu tidak menebak gambar hingga waktu habis	Game akan memuat soal selanjutnya	Game memuat soal selanjutnya	Valid
7	Gameplay permainan puzzle	Pemain membuka halaman permainan puzzle lalu menyusun puzzle hingga selesai sebelum waktu habis	Skor pemain akan bertambah	Skor bertambah	Valid
		Pemain membuka halaman permainan puzzle lalu tidak menyusun puzzle hingga selesai sampai waktu habis	Pemain akan diberi gambar utuh dan memuat puzzle selanjutnya	Pemain diberi gambar utuh dan memuat puzzle selanjutnya	Valid

B. Analysis of Usability Testing results

Based on the data recapitulation of usability test results, it addressed 62 children aged 12-19 years. There are 15 assessment criteria, each of which is given five answer options, namely "Strongly Disagree", "Disagree", "Hesitating", "Agree", and "Strongly Agree". Each answer has different points ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The collected test data will be processed using the Likert scale rule. After the data is processed, the results are obtained as in Table II. The table below shows the percentage is in the range of 80%-100%, which means "Very Good".

TABLE III. USABILITY TEST RESULTS

No.	Kriteria	Pilihan Jawaban					Score	Percentage (%)
		SS	S	RG	TS	STS		
1	Pemain mudah untuk memahami permainan	47	15	0	0	0	295	95.16%
2	Pemain mendapatkan pengetahuan dari permainan	46	16	0	0	0	294	94.84%
3	Pemain merasa terhibur dengan permainan	40	20	2	0	0	286	92.26%
4	Pemain akan merekomendasikan permainan ini kepada teman dan kerabat	24	33	5	0	0	267	86.13%
5	Tampilan permainan nyaman untuk dilihat	37	24	1	0	0	284	91.61%
6	Audio pada permainan sudah nyaman didengar	36	23	3	0	0	281	90.65%
7	Pengontrolan permainan sudah sesuai dengan standar	36	26	0	0	0	284	91.61%
8	Bahasa yang digunakan mudah dipahami	43	18	1	0	0	290	93.55%
9	Fitur pada permainan sudah lengkap	37	19	5	1	0	278	89.68%
10	Pengalaman bermain menyenangkan	31	29	2	0	0	277	89.35%
11	Konten pariwisata pada game sudah terbaru	34	25	3	0	0	279	90.00%
12	Tampilan permainan sesuai dengan layar perangkat <i>mobile</i>	46	16	0	0	0	294	94.84%
13	Dengan adanya skor dan waktu menjawab, pemain merasa tertantang untuk bermain	36	25	1	0	0	283	91.29%
14	Dengannya adanya penjelasan mengenai daerah yang dipali, pemain dapat lebih mengenal daerah tersebut	39	21	2	0	0	285	91.94%
15	Dengan adanya soal yang bervariasi pemain tidak merasa bosan saat bermain	34	26	2	0	0	280	90.32%

C. Analysis of the results of the User Experience Questionnaire Test

In UEQ, there are six factors to be measured: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty. The results obtained from these criteria will be processed to obtain the average value as in table III. In the UEQ, it is stated that the average value of each factor is in the range of -3 to +3. An average value of -3 indicates a negative evaluation result, while an average value of +3 indicates a positive evaluation result. The average value between -0.8 to +0.8 indicates a neutral evaluation result.

TABLE IV. USER EXPERIENCE QUESTIONNAIRE RESULTS

Faktor	Pre-Test	Post-Test
Attractiveness	↓ -1.683	↑ 2.311
Perspicuity	→ -0.725	↑ 2.142
Efficiency	↓ -1.692	↑ 2.317
Dependability	↓ -1.558	↑ 2.083
Stimulation	↓ -1.750	↑ 2.117
Novelty	↓ -1.533	↑ 1.800

It can be seen in Table II the comparison of the results of the pre-test and post-test conducted to measure user experience. In the pre-test, the attractiveness, efficiency, dependability, stimulation, and novelty factors were negative, and perspicuity factors were neutral. In the post-test, all the measured factors showed positive evaluation results. If the results of the two tests are compared, it can be seen that there is an increase in the results of the evaluation of UX measurements after the re-engineering process is carried out.

When visualized in graphical form, the following is a description of the results of the tests carried out.

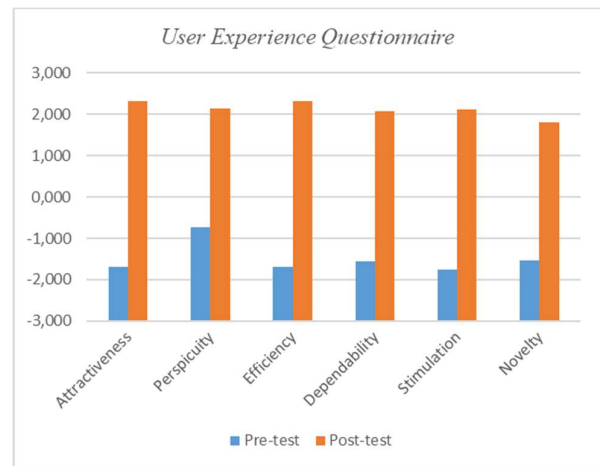


Fig. 6. UEQ Hasil Results Comparison

V. CONCLUSIONS

Based on all phases of the activities that have been carried out, in this study can be concluded that from the results of usability testing, the level of user satisfaction is in the range of 80%-100%, which means Very Good. Moreover, based on the User Experience Questionnaire results, which was conducted to measure user experience when playing the game 'Ayo Wisata ke Riau' the scale is 0.8 up to 3, which means the user experience while playing is very good. So it can be concluded that the 'Ayo Wisata ke Riau' game meets the quality needs of tourism educational mobile games in Riau Province.

So this research proves that the process of re-engineering the 'Ayo Wisata ke Riau' game increases user satisfaction by 49.7% and improves user experience in using the application.

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