ISAR Journal of Science and Technology

Volume 2, Issue 12, 2024, Page: 13-16

Abbriviate Title- ISAR J Sci Tech

ISSN *(Online)*- 2584-2056

https://isarpublisher.com/journal/isarjst

Evaluation of User Experience in Augmented Reality Gamification Applications in the Tourism Sector

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Article History

Received: 18.10.2024
Accepted: 22.11.2024
Published: 08.12.2024

Abstract: The evaluation of user experience (UX) in Augmented Reality (AR) apps is crucial for assessing the quality of interaction between users and applications, particularly within the tourist industry. An AR interactive game application created for The Sila's Agrotourism in Bali seeks to provide a more immersive and instructive tourism experience through the integration of monster hunting game features. Despite employing AR technology to deliver a novel experience, it is crucial to assess the degree to which this app fulfills user expectations. This study is to assess the user experience of the application utilizing the User Experience Questionnaire (UEQ), including six principal dimensions: Attractiveness, Clarity, Efficiency, Accuracy, Stimulation, and Novelty. This research employs data gathering using a UEQ questionnaire administered to 34 participants who have utilized the application. Data analysis was conducted utilizing descriptive statistics, including the computation of the mean and standard deviation. The evaluation results indicate that the app received favorable scores across nearly all categories, particularly in Attractiveness, Clarity, and Novelty, suggesting its efficacy in capturing attention and delivering enjoyable new experiences. Nevertheless, the Stimulation component received a little lower score, suggesting opportunities for enhancing user involvement. The program functioned adequately; however, enhancements to the stimulation component could elevate the overall quality of the user experience.

Keywords: User Experience, Augmented Reality, Interactive Game, UEQ, Tourism.

Cite this article:

Aristana, M. D. W., Sanusi, R., Sudipa, I. G. I., Radhitya, M. L., (2024). Evaluation of User Experience in Augmented Reality Gamification Applications in the Tourism Sector. *ISAR Journal of Science and Technology*, *2*(12), 13-16.

Introduction

User experience (UX) is an important aspect that affects the success of an application, especially in the context of applications based on Augmented Reality (AR) technology. AR technology enables the integration between the real world and the virtual world, providing a more interactive and immersive experience (Aristana & Ardiana, 2021; Çeltek, 2021; Sudipa et al., 2024; Verhulst et al., 2021). In recent years, the use of AR technology in the tourism sector has attracted significant attention, as it is able to offer an interesting and different experience from conventional tourist experiences. One example of an interesting application of AR technology is an AR-based interactive game application developed for The Sila's Agrotourism (Aristana et al., 2024), an agrotourism tourist destination located in a mountainous area. This application combines elements of a monster hunting game with AR technology, creating an experience that is not only entertaining but also educational for visitors (Rahmadina et al., 2024).

This AR-based game application is designed to increase tourist attraction by providing a new, more immersive experience, where users can interact with virtual objects scattered around the tourist area (Wiguna et al., 2023). This application system utilizes marker-based and markerless AR technology that works together with GPS features to allow users to find and interact with virtual objects in the real world. Through this application, visitors can explore tourist sites more interactively, interact with various virtual characters, and get information related to the uniqueness of nature and culture around them. This approach is expected to enhance the tourist experience by offering an experience that brings together entertainment, education and fun (Aditama et al., 2020, 2024; Sudipa et al., 2022a), and exploration(Aditama et al., 2022).

However, although AR technology offers great potential for creating engaging experiences, it is important to measure the extent to which the application is accepted by users and provides a satisfying experience (Putra et al., 2023). In this context, user experience testing is essential to assess the quality of interaction between the user and the application (Aditama et al., 2023; Yanti et al., 2023, 2024), as well as to understand how effective the application is in meeting user expectations. One instrument that can be used to measure the overall quality of user experience is the User Experience Questionnaire (UEQ). UEQ is a comprehensive measurement tool that covers various dimensions of user

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experience, such as attractiveness, efficiency, clarity, accuracy, stimulation, and novelty. By using UEQ, the evaluation of this application will not only focus on technical aspects and functionality(Sudipa et al., 2022b), but also on the emotional quality and engagement that users feel while interacting with the app.

Through UEQ testing on the AR-based interactive game application at The Sila's Agrotourism, this research aims to provide a more in-depth overview of the aspects that need to be improved and further developed in the application. The results of this test are expected to provide valuable insights for application developers, both to improve design, functionality, and user interaction in the future (Pagano et al., 2020; Vergari et al., 2022). In addition, this research also has a broader impact, providing a reference for other tourist destination managers who are interested in adopting AR technology as part of their efforts to improve the quality of the visitor experience. By understanding user perceptions and needs, developers can create better applications, which not only provide benefits in terms of entertainment but also increase overall traveler satisfaction and engagement.

Method

User Experience Questionnaire (UEQ) testing on the AR interactive game application at The Sila's Agrotourism was carried out by distributing questionnaires to users who had interacted with the application. This questionnaire consists of 26 questions designed to assess six main dimensions of user experience, namely: Attractiveness, Clarity, Efficiency, Precision, Stimulation, and Novelty (Noreikis et al., 2019; Wijaya et al., 2021).

Testing Subject

The testing involved 34 respondents who had used the interactive game application. The respondents came from various backgrounds, including visitors to The Sila's Agrotourism who used the app during their visit to the location.

Testing Instrument

The main testing tool used in this research is the User Experience Questionnaire (UEQ) which consists of 26 statements. Each statement in this questionnaire is given a rating scale from 1 to 7, with the following ratings: 1: Strongly disagree, 2: Disagree, 3: Tend to disagree, 4: Neutral, 5: Tend to agree, 6: Agree, 7: Strongly agree. This scale is used to measure the six main dimensions that are the focus in user experience assessment.

Data Collection Process

After the respondents used the app, they were asked to fill out a questionnaire containing 26 questions related to their experience while interacting with the app. The data was collected online through a survey platform, and respondents were given one week to complete the questionnaire.

Data Analysis

The data collected from the questionnaires were analyzed using descriptive statistical methods, which include the calculation of mean, variance, and standard deviation. The results of this analysis will provide an overview of the quality of the user experience based on their perception of the AR interactive game application. Then, these results are compared to the UEQ benchmark values that have been set for similar applications to provide further perspective on the quality of the application.

Results and Discussion

UEQ Testing Results

Based on the results of questionnaire data processing, the average value for each dimension measured is obtained, which is then categorized into three groups based on the average score obtained from the 34 answers, which will be converted into mean, variance and standard. Each statement will be color-coded according to its category, such as efficiency, novelty, stimulation, clarity, and attractiveness. Arrows pointing upwards will be green with a mean value >0.8, indicating a positive evaluation. Horizontal arrows will be yellow with values between >0.8 to <-0.8, indicating a neutral evaluation. And the downward-pointing arrow will be red with a value <-0.8, indicating a neutral evaluation.

Table 1. UEQ Scale Results

UEQ Scales (Mean and Variance)		
Attractiveness	2,137	0,32
Clarity	2,096	0,39
Efficiency	2,074	0,25
Accuracy	2,044	0,20
Stimulation	1,934	0,33
Novelty	2,096	0,22

The following are the analysis results for each dimension:

1. **Attractiveness**

   The average score for the attractiveness dimension is 2.137, which indicates that the app is attractive to most respondents. This shows that the app successfully captured the attention of users and provided a fun and entertaining experience. The respondents felt attracted to the concept of a monster hunting game using AR technology that allows them to interact directly with their surroundings.

2. **Clarity**

   The clarity dimension received an average score of 2.096, which also shows positive results. This means that users felt that the app interface was clear and easy to understand. Users do not experience confusion in navigating the application and can easily understand how the application works, both in terms of login, games, and settings.

3. **Efficiency**

   The score for efficiency is 2.074, which indicates that the app works efficiently. Users find the app responsive and do not experience significant bottlenecks in using the app's basic features such as login, navigation, and information search.

4. **Precision**

   The accuracy dimension obtained an average score of 2.044. This indicates that the app managed to deliver precise and accurate results, both in terms of basic functions such as login and the use of AR to detect monsters, as well as in terms of user interaction with various game elements.

5. **Stimulation**

   The score for stimulation is 1,934, which is slightly lower compared to the other dimensions. Although the app is quite engaging, there were some users who felt less stimulated by the content or experience provided. This could indicate that there is room to increase the level of user engagement through additional features or more dynamic interactions within the game.

6. **Novelty**

   The novelty dimension scored 2.096, indicating that the app provides a positive new experience for users. The AR technology used provides significant added value and makes this application more attractive to tourists who want to have a different experience when visiting attractions.

Discussion

Based on the UEQ test results, overall, the interactive AR game application for The Sila's Agrotourism received a very positive evaluation. The average scores for all dimensions tested were above the positive evaluation threshold, with the Attractiveness, Clarity, and Novelty dimensions scoring the highest. This indicates that the app is highly successful in attracting users' attention, providing a clear and easy-to-understand interface, and offering a new experience that thoroughly combines the real and virtual worlds.

However, while most dimensions showed positive results, the Stimulation dimension had a slightly lower score. This indicates that there are opportunities to improve the user experience in terms of engagement and interactivity. For example, the addition of more in-depth story elements, more varied challenges, or increased interaction with virtual characters could improve the sense of stimulation and player engagement.

In addition, the test results also show that the app can be easily accessed and used by visitors with varying levels of technological expertise. The clear interface and intuitive navigation system make the app usable by anyone without the need for training or in-depth technical knowledge.

Comparison with UEQ Benchmark

The UEQ analysis results for this app were compared with the UEQ benchmarks obtained from similar apps in the market. Overall, the app received above-average results in terms of pragmatic and hedonic qualities. This indicates that the app meets the expectations of both developers and visitors, providing an experience that is not only useful and efficient, but also fun and engaging.

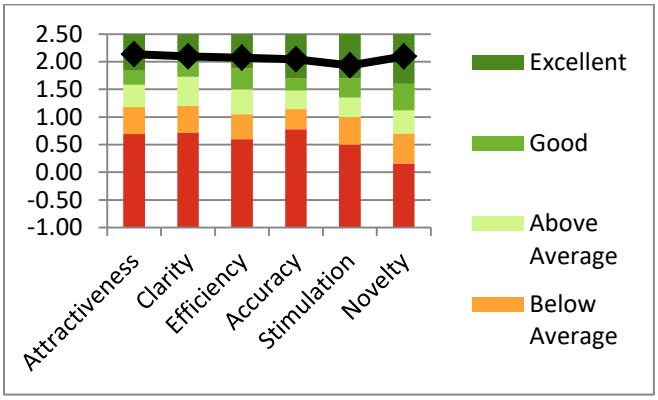

Figure 1. Benchmark Scale Results

Conclusion and Suggestions

Based on the UEQ test results, the augmented reality interactive game application for The Sila's Agrotourism showed excellent results in terms of user experience. The app successfully captured the user's attention with a clear interface, provided a fun new experience, and worked efficiently. Although there are some areas that could be improved, especially in terms of user stimulation and engagement, overall the app can be considered successful and fulfills its development goals. For further development, a focus on improving elements that can increase user stimulation and interaction will further enhance the quality of this application.

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