

Verification of effect for tourism application ‘Mawari-michi Kenrokuen’ using gamification

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Abstract

Japan's tourism industry has been severely affected by the COVID-19 pandemic and disasters such as earthquakes. Maintaining sustainable tourism management is required even under these circumstances. In addition, the decline in the number of people working in the tourism industry due to the declining birthrate is an issue that must be resolved. One of the possible solutions to these issues is to promote local and neighboring tourism (micro-tourism), and cultivate the local respect and increase the tourist population of the area. However, it is difficult to arouse and maintain motivation and desire to return due to novelty and surprise, when it comes to sightseeing in the local area or neighboring areas. Therefore, this study focused on the design method of gamification and developed a tourism application that can increase tourism satisfaction and the desire to revisit even familiar local tourist destinations. In the development, one of Ishikawa Prefecture's representative tourist spots (Kenrokuen garden) was targeted. The garden is located in the center of Kanazawa city. The application name is 'Mawari-michi Kenrokuen.' This paper reports on the results of its design, development, and operation verification. In this study, the verification experiment of the application using students living near Kanazawa as subjects was conducted. As results, the following effects were obtained by using this application, namely increased tourism satisfaction and increased desire to revisit tourist spots that had not been visited.

Keywords

gamification, tourism satisfaction, application development, micro-tourism, Kenrokuen

1. Introduction

The tourism industry was severely affected by the COVID-19 pandemic and natural disasters [Japan National Tourism Organization, 2024; Japan Tourism Agency, 2021]. Micro-tourism is a form of sustainable tourism even under these influences [Hoshino, 2022]. Micro-tourism is short-distance, short-term, and small-group travel, and it can be carried out even if the use of public transportation is restricted. Since the targets of micro-tourism are short-distance tourist destinations, the targets are necessarily neighboring areas with which people interact on a daily basis and have strong economic ties. Micro-tourism provides a good opportunity for local residents to recognize the good local life and pride and rediscover its charm [Tozaki, 2018; Kobayashi, 2021]. It draws attention to the local area where she/he is living, promotes attachment to the local area, and contributes to expanding the connected population of neighboring areas. The nearby destination is a place that people are familiar with and have an attachment to, but it is less attractive in terms of new awareness and a sense of freedom, which is one of the motivations for tourism. For example, Sasaki categorizes the travelers' motivation into the following five behaviors for the destination, namely: (1) tension-relieving behavior, (2) entertainment-seeking behavior, (3) relationship-enhancing behavior, (4) knowledge-enhancing behavior, and (5) self-aggrandizing behavior. Furthermore, he categorizes them

into four categories when consuming travel products: ease, fun, novelty, and risk [Sasaki, 2004; 2005; Hayashi and Fujihara, 2012]. Micro-tourism is classified into: (1) tension-relieving behavior (escape from everyday life), and (2) entertainment-seeking behavior (adventure and challenge) when it is applied to the above classification. For this reason, it is difficult to motivate tourists in terms of novelty and danger, and it is expected that tourism satisfaction will be low.

The tourist motivation and satisfaction for sightseeing to nearby areas were increased by using the gamification design in our previous research, and tourists' desire to revisit has increased [Futakuchi et al., 2024]. Gamification is a design method for attracting users in computer games. The design is used for purposes other than games, such as education, customer retention, health maintenance, and saving money. For example, the application 'iDenkimeter' which turned into a game to see whether each person could meet their own energy-saving goals or not, attracted attention during the Great East Japan Earthquake in 2011 [Inoue, 2012]. This is an example that succeeded in creating elements such as challenge and novelty, and making it more enjoyable by making people aware of everyday events as games. Several tourism applications, such as map applications and audio guide applications, already exist, but none have used gamification techniques to enhance the tourist experience. Therefore, Futakuchi et al. targeted *Kenrokuen* which is a representative tourist destination (garden) in Ishikawa Prefecture, and attempted to incorporate gamification elements into visiting *Kenrokuen* to increase visitor satisfaction and the desire to revisit. This mobile application is named 'Mawari-michi Ken-

rokuen.’ The operational verification of this application and the subjective evaluation were performed by the experimenters in this study. However, it was necessary to verify the effect on actual tourists. The practical verification experiment of this application was carried out in this study. The subjects were men and women around the age of 20 attending three universities/college near *Kenrokuen*. As a result, the satisfaction with the visit was higher when the application was used than when the application was not used. Additionally, the subjects were more willing to revisit other spots they had not visited on the day of the experiment. The outline of the application, experimental method, results, and discussion are discussed in the following chapters.

2. *Kenrokuen* tourism application ‘*Mawari-michi Kenrokuen*’

2.1 Configuration of the application

The *Kenrokuen* tourism application ‘*Mawari-michi Kenrokuen*’ (it is simply referred to as the application from here on) is used on smartphones inside *Kenrokuen* by tourists. This application is only compatible with Android OS due to equipment and development environment. The developmental environment is Android Studio (ver. Hedgehog) [Alphabet, 2023a]. Google Maps API is utilized to obtain location and route information [Alphabet, 2023b]. The screen configuration of the application is indicated in Figure 1.

The application consists of home fragment screen and achieve fragment screen. The current location of the player (tourist) is displayed on the map on the home screen when the application is started. The twenty-seven famous spots within *Kenrokuen* Garden that have been set as photo spots are displayed as pins on the map. Players can easily check their current location and the location of famous spots within the park using this function. The screen with photos of the four seasons and detailed text information for the spot are displayed by tapping the pin of a photo spot. This action allows the player to obtain detailed information about seasonal scenery and spots other than on the date of visit. One of the goals of this application is to reach a photo spot. When the player reaches a photo

spot, a sound effect is played and the pin changes to a reached mark. Home fragment and achieve fragment (screen) can be switched freely. The following four types of the action histories of the players are displayed, namely: (1) number of steps walked in the park, (2) number of photo spots reached so far, (3) cumulative number of visits to *Kenrokuen*, (4) display the earned badges. The badges have different designs depending on the season visited and are given as special rewards. The player’s action history and reward achievement status are automatically recorded from the moment the player enters *Kenrokuen*.

2.2 Gamification design of application

In gamification, player’s willingness and motivation are created by cycling through the following six steps, namely: (1) promoting active participation, (2) setting achievable goals, (3) building uniqueness through free action (4) instant feedback for players’ actions, (5) performance of praise, (6) visualization of growth [Kishimoto, 2023, Tanaka and Kishimoto, 2022]. Rewards in gamification do not necessarily have to be valuable rewards such as real money. The following are rewards that increase player motivation: performances that praise the achievement of goals set in the game, titles, trophies and badges, etc. that can be obtained in the game. The system provides a feedback such as reactions (effects) to the player’s actions in the game. Items are also a kind of reward, for example visualizing the player’s growth by recording and displaying actions and the results.

In this application, reaching a photo spot is treated as a gamification element, and the selection, reaching spot, feedback, praise, and visualize of the photo spot accomplished due to the player are performed. After experiencing the gamification elements, the photo spots that have been reached are visualized on the home fragment (screen), and the number of reached spots is quantified on the achieve fragment (screen). Those arouse the interest in unreached photo spots and the desire to conquer the spots the player has not conquered yet. In addition, the rewards include to visualize the degree of the achievement based on action history, such as displaying the number of steps taken

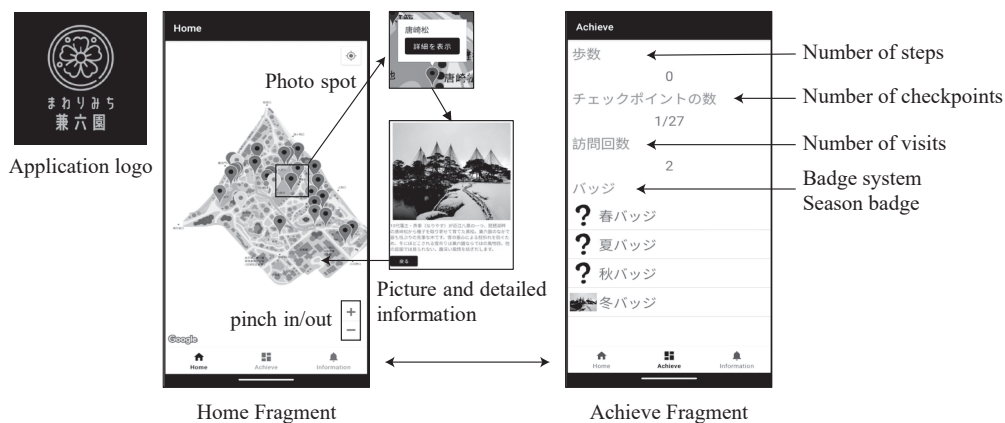


Figure 1: Screen configuration of the developed application

and number of visits, as well as a badge system. These rewards are designed with reference to the Bartle test. It is a method of classifying the characteristics of game players [Bartle, 1996]. A type of player who is highly interested in the game itself and enjoys playing the game alone is classified as an ‘achiever’ in the test. This application is designed with rewards for achievers, with the intention of allowing tourists to explore and enjoy *Kenrokuen*’s attractions, whether or not they are accompanied by a companion. And the game classifies the players into light, middle, and core users (grades) based on the average number of attempts per play. The goal achievement rate and success rate per trial are derived for each player. This application assumes that the user who is using the application for the first time is a light user. It is designed to achieve 60-80 % of the goals in the application on the first visit (number of attempts). This provides a sense of satisfaction for micro-tourism by achieving a success rate of 50 % or more in just one visit. The players will be encouraged to complete the remaining goals by not allowing them to accomplish all the goals in one visit. Namely it is intended to motivate repeat visits.

3. Experimental method

3.1 Subjects

This study focuses on the increase in the tourist population, especially the increase in the young generation. Subjects who met the following three conditions were selected: living near *Kenrokuen*, age enough to go sightseeing alone, familiar with games and smartphones since childhood. The subjects were recruited from two universities and one college in Ishikawa Prefecture (Kanazawa University, Kanazawa Seiryō University and National Institute of Technology, Ishikawa College). The outline and purpose of the study were explained to the subjects, and they were asked to apply using an online application form if they were willing to participate. The number of subjects was 28. The details of the subjects are shown in Table 1. The gender of the subjects was 15 females and 13 males, and the average age was 19.57 years (*SD* 1.66).

Table 1: Number of subjects

Gender	Number	Age	
		Mean	SD
Female	15	19.00	1.10
Male	13	20.23	1.93
Total	28	19.57	1.66

3.2 Ethical considerations

The purpose of this study and the following ethical considerations were explained to all subjects at the time of application and during the briefing before participation, and the consents were obtained.

- Responses to the questionnaires conducted within the survey

are voluntary, and there is no disadvantage for not responding

- There will be no disadvantage to the subject if he/she discontinues participation in the middle and when he/she feels like discontinuing the participation in the middle of the survey
- The responses to the survey are anonymized and aggregated, and individuals cannot be identified
- The personal information obtained through surveys are strictly managed

This study was conducted after undergoing ethical review and approval by the institution to which the author belongs.

3.3 Experimental equipment

The main experimental equipment were three smartphones equipped with Android OS 12 (Google Pixel3, Aquos SH-RM12, Lenovo TB-X606FA). All experimental equipment was reset to factory defaults before starting the experiment, and the OS was updated to the latest version and the experimental application was installed using the developer mode. The subjects initialized all application history with location information disabled before starting the experiment. Each subject enables the location information and starts the application when using. Various setting items such as screen display and volume for each smartphone were all unified by the experiment manager.

3.4 Experimental procedure

The experimental period was June 7th to June 15th, 2024. The experiments were conducted at a date and time during which the subjects could participate within this period. However, the experiments were not conducted on a rainy day. The subjects gathered at one of the entrances of *Kenrokuen* (Kodatsuno-guchi), which was the starting point of the experiment, and received an explanation of the experiment from the experiment manager. Each subject participated in the experiment alone, in order to exclude the effect of the presence or absence of a companion on satisfaction and to simply evaluate only the effectiveness of the application. After that, the subjects answered a questionnaire before starting the experiment. The subjects performed the experiment in the following two cases.

- Visiting *Kenrokuen* using the developed application (using a smartphone, A-group)
- Visiting *Kenrokuen* using a printed paper tourist guide (using a printed guide, B-group)

All subjects performed the two conditions consecutively on the same day. In order to avoid being influenced by the above experimental order, the following two types of procedures were adopted, namely the experiment participants were divided into the following two groups, half of participants used smartphones (A-group) and the other half used the paper guides (B-group). The participants experience the A- and B-group alternately. The subjects (participants) walked around the park

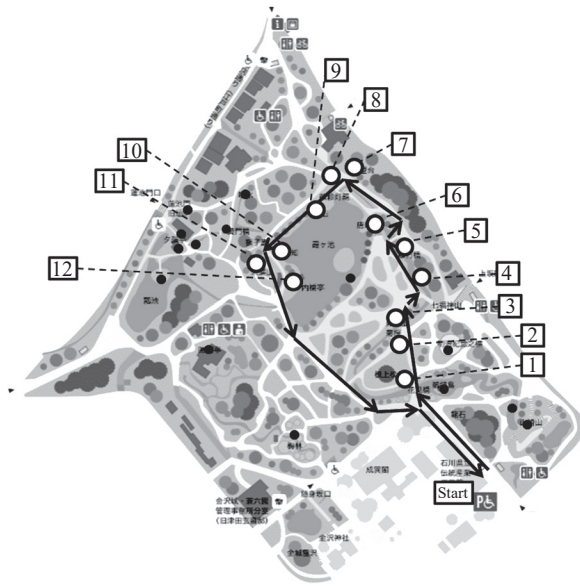


Figure 2: Visiting route for experiments

following the route indicated by the experiment manager and checked the photo spots they reached along the route. The above conditions and visiting route were the same for all subjects. The visiting route is shown in Figure 2. The route for this experiment includes 12 spots of the 27 photo spots in the park. Each subject was told not to use their personal smartphone during the experiment and not to change the settings of the experimental equipment. The subjects completed a survey regarding their satisfaction with the visit at the end of each visit. The subjects completed a questionnaire regarding the use of the application after the two types of experiments. This completes the experiment for each subject.

3.5 Questionnaire items

A questionnaire was conducted at the beginning of the experiment and at the end of the experiment visiting the park (using smartphone and using printed paper). All questionnaires were filled out using an online web form. Each subject was given a unique 6-digit string of letters and numbers as a participant ID at the beginning of the experiment. The subjects answered all questionnaire items using their participant ID.

The subjects' basic attributes and their awareness of the visit were investigated in the pre-experiment questionnaire. The following five questions were asked: (1) gender, (2) age, (3) preference for travel (questionnaire 5-point method), (4) previous travel experience (questionnaire 5-point method), and (5) things to consider when traveling (multiple selection possible). These questions included more detailed items such as the experience of visiting *Kenrokuen* only, the number of people on the trip, etc., but these were omitted in this report for simplicity.

Seven questions to assess their satisfaction with their visit to *Kenrokuen* and their desire to return were asked at the end of the two types of experiments (A- and B-groups). The seven questions were: (1) satisfaction with the places visited (Visited

spots: satisfaction), (2) interest in other seasons of the visited spot (Visited spots: interest in other seasons), (3) interest in spots the subject did not visit (Unvisited spots: interest), (4) do you want to try visiting the spots you have not visited if there was no designated route? (Unvisited spots: willingness to visit during experiment), (5) do you want to revisit the spots you haven't visited? (Unvisited spots: willingness to revisit), (6) overall visit satisfaction (Overall tour: satisfaction), and (7) would you like to visit again after this visit? (Overall tour: willingness to revisit). Each question was answered on a 9-point Likert scale: 1 is 'I don't think so at all,' 5 is 'I can't say either way' and 9 is 'I strongly agree.'

The subjects were asked to answer the written questions regarding the functions and usage of the application in the questionnaire at the end of the experiment. Questions in the questionnaire were as follows: (1) about the difference depending on whether or not you use the application, (2) thoughts on the application's photo spot notification function, (3) thoughts on the function that displays action history and badges on the achieve fragment (screen), and (4) overall satisfaction with application usage.

4. Experimental results and discussion

4.1 Subjects' awareness of tourism

The results of a survey of subjects' awareness of tourism conducted before the start of the experiment is shown in Figure 3. The preference for travel was high for both men and women as shown in Figure 3 (a). The average value was 4.6 for women and 4.2 for men. The tendency is higher in women. Figure 3 (b) shows that both men and women were average in their experience of travel. The average value was 3.3 for women and 2.8 for men, which showed a tendency to be higher for women. The following items were frequently cited by both men and women as important points when traveling. The results are shown in Figure 3 (c), namely the main destination and food at the destination. There were 10 responses for women and only 3 for men in the item 'Nature and scenery of tourist spots.' This shows a difference between men and women.

4.2 Comparison of application guide and printed paper guide

The satisfaction survey regarding the application guide and printed paper guide was conducted at the end of the *Kenrokuen* visit experiment. At this time, a total of the seven questions regarding tourism satisfaction shown in the previous section was used as the overall tourism satisfaction evaluation score. The scores of the application guide and printed paper guide were compared. The tourism satisfaction evaluation scores for each condition are shown in Table 2 and Figure 4. Both men and women have higher tourism satisfaction with application guides than with paper guides according to the results. Women's tourism satisfaction scores are higher than the ones for men's in paper guides. Both men and women had similar tourism satisfaction scores in the application guide. An analysis of



Figure 3: Subjects' awareness of tourism

variance was performed using the tourism satisfaction evaluation score as the objective variable and gender and guide type (application or printed paper) as explanatory variables. The post hoc comparisons were performed using Tukey HSD when the main effect of each variable was significant. jamovi (ver. 2.4.14) was used for analysis [jamovi, 2024]. As a result, the

Table 3: Tourism satisfaction scores for each question including typical statistical coefficients

		Visited spots: Satisfaction	Visited spots: Interest in other seasons	Unvisited spots: Interest	Unvisited spots: Willingness to visit during experiment	Unvisited spots: Willingness to revisit	Overall tour: Satisfaction	Overall tour: Willingness to revisit
Paper guide	Mean	6.89	6.75	6.04	7.25	5.14	6.82	5.96
	SD	1.26	1.90	1.67	1.60	2.24	1.44	2.19
Application guide	Mean	6.86	7.21	7.14	7.32	6.54	7.11	6.54
	SD	1.80	2.08	1.72	1.54	2.08	1.45	1.93
Welch's <i>t</i> -test		0.93	0.43	0.03	0.85	0.02	0.50	0.34

Table 2: Tourism satisfaction rate for each condition

Guide		Female	Male
Paper guide	Mean	47.20	42.15
	SD	8.87	9.43
Application guide	Mean	48.67	48.77
	SD	8.87	9.41

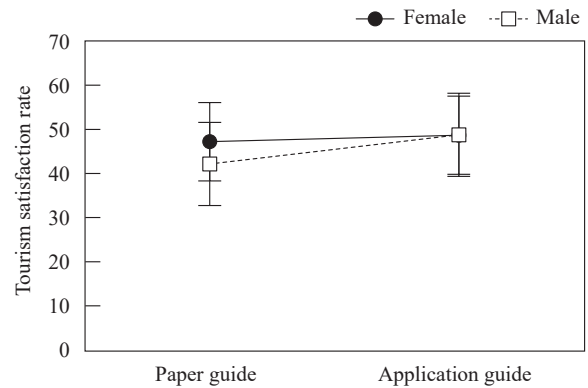


Figure 4: Tourism satisfaction rate for each condition

main effect of guide type on tourism satisfaction scores was significant ($F(1, 26) = 7.14, p < 0.05$). There was no significant difference in the main effect of gender ($F(1, 26) = 0.59, p = 0.45$) and the interaction between the guide type and gender ($F(1, 26) = 2.90, p = 0.10$).

There was a significant difference in tourism satisfaction scores between the experimental results using the application guide and the paper guide. Tourism satisfaction scores were compared for each question and compared using Welch's *t*-test. The tourism satisfaction evaluation scores for the application guide and paper guide for individual questions are shown in Table 3 and Figure 5. As a result of comparing each question, the evaluation of the application guide was higher than that of the paper guide, except for the question regarding satisfaction with visited spots (Visited spots: satisfaction). The application guide particularly received high scores for the following two items, namely the interest in other places the subjects have not visited (Unvisited spots: interest) and willingness to visit places the subjects have not visited (Unvisited spots: willingness to revisit).

5. Consideration

It is considered that the tourism application developed in this study is effective in increasing the subjects' tourism satisfaction since the application guide has higher tourism satisfaction scores than that of the paper guide. Comparing the satisfaction scores by question, the application guide received high ratings for the following two questions, namely: interest in other places the subjects have not visited (Unvisited spots: interest) and willingness to visit other places the subjects have not visited (Unvisited spots: willingness to revisit). The subjects were able to understand the spots they did not visit during actual visiting and became interested in those spots by using the developed application. There are many words that using the application made it easier to understand and less confusing in the questionnaire at the end of the experiment. In other words, providing photo spots and location information have made the sightseeing easier to understand. The subjects were unable to confirm their location information in the paper guide group because they were instructed not to use their own smartphones during the experiment. Further verification regarding the above mentioned results is necessary. The questionnaire results at the end of the experiment showed that the subjects felt a sense of accomplishment when they reached photo spots and were motivated to conquer the photo spots they had not visited yet. This is an important effect of the gamification designed in this application. Young people around the age of 20 were targeted in this study but there is a future challenge to investigate how this effect affects other age groups.

Many of the negative words in the application reviews were related to the sound effects when reaching the photo spot. The sound effects were set at a high volume in this study so that they could be easily heard within the park. Additionally, the subjects were instructed not to change the smartphone settings during the experiment. There were times that the surrounding tourists could hear the sound during the experiment. This is not a big problem as the user can select the appropriate volume by adjusting the volume or using earphones. However, there is a need to consider the sound effect.

There were differences in the trends depending on gender in the travel awareness survey conducted at the beginning of the experiment and the tourism satisfaction evaluation conducted at the end of the experiment. In the travel awareness survey, it was found that women were more likely than men to be interested in the 'nature and scenery of tourist spots.' Women tended to rate higher than men in terms of tourism satisfaction score when using the paper guide. The paper guide is in the same condition as ordinary sightseeing, and women are more satisfied with *Kenrokuen* sightseeing than men. In a survey conducted by the Jalan Research Center [2024] regarding the differences in the attitudes of men and women toward travel, women had a higher overall desire to travel and were more interested in tourism aimed at nature and famous places than men. This is consistent with the results of this study. The charm of *Kenrokuen* is its 'nature and famous places.' The

photo spots are also 'nature and famous places.' It can be said that women are highly satisfied with *Kenrokuen* tourism from the above. On the other hand, the application guide had higher tourism satisfaction for both men and women than the paper guide (the score similar for men and women). Therefore, the use of this application can improve tourism satisfaction regardless of gender.

As a future challenge, it will be necessary to conduct verification at tourist destinations other than nature and famous places, and to develop applications that are not limited to the type of tourist destination.

6. Conclusion

In this study, the effectiveness of '*Mawari-michi Kenrokuen*' (*Kenrokuen* tourism application) was verified, which was developed using gamification design methods. This application is designed to increase the satisfaction with sightseeing and the desire to revisit even familiar places. The aim is to solve various problems such as promoting local tourism typified by micro-tourism. The effectiveness of this application using young people as subjects, who are likely to be the recipients and providers of the services in the tourism industry in the future, were investigated. As a result, the tourism satisfaction scores were significantly higher in the application guide. And it was shown that the evaluation of the desire to visit tourist spots that were not visited was higher. A text mining analysis of the questionnaire conducted at the end of the experiment revealed the positive impressions regarding the application's functions and usage, including that it was easy to understand, fun, and motivated to conquer unvisited spots. The usefulness of the developed application was recognized.

In the future, the effectiveness of the developed application for generations other than the young generation and the effectiveness of gamification at various tourist destinations (for example, a tourist attraction that differs from *Kenrokuen* in size and density of photo spots), will be verified, and the functionality of the application will be also improved. As a technical challenge, it is also necessary to be able to import external databases into the application, so that it can be converted to another application for a different tourist attraction and be multilingual.

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