International Journal of Advanced Culture Technology Vol.8 No.4 25-32 (2020)
DOI https://doi.org/10.17703/IJACT.2020.8.4.25

IJACT 20-12-4

Museum Gamification Design using Story Elements

Se-Won Jeon* , Gihwan Ryu** and Seok-Jae Moon***

**Kwangwoon University, Graduate School of Smart Convergence, Institute of Tourism Industry, Graduated, Seoul, Korea*
***Kwangwoon University, Graduate School of Smart Convergence, Institute of Tourism Industry, Professor , Seoul, Korea*
****Kwangwoon University, Institute of Information Technology, Professor, Seoul, Korea*
E-mail : { sw2947, allryu, msj8086}@kw.ac.kr

Abstract

Currently, Korean museums use gamification in addition to various viewing methods, such as video and VR/AR. However, museums using museum gamification are still progressing to a special program level. The purpose of this paper is to make the contents of the museum easy to understand and to give the viewers fun. This paper goes beyond the existing museum gamification and proposes a museum story gamification that combines story elements with gamification. This proposal system collects information from each museum in cooperation with museums, art galleries, and exhibition halls and proceeds with related story games. Museum Story Gamification provides related stories according to the theme of the museum and allows viewers to select their own stories. Also, based on the story, you can directly select the difficulty level that suits you and play a personalized game. Unlike the general museum program, the methodology proposed in this paper allows visitors to experience the museum with various story contents. In addition, it will contribute to the development and implementation of programs with gamification in other tourism fields as well as museums.

Keywords: *Museum, Gamification, Museum education, Museum game, Tourism*

1. Introduction

Recently, gamification has been widely used in fields such as education, healthcare, corporate marketing, culture, and arts [1]. In particular, museums are also utilizing gamification that can be extended to the viewer's experience, away from the usual way of preserving existing data [2]. However, Korean museums operate at the level of a special viewing program to which gamification is applied and are still in the introduction stage [2]. In addition, it consists of only basic game elements, and it is difficult to grasp the internal motives of visitors [3,4]. Examples of Korean museums with existing gamification are Nexon Computer Museum and National Daegu Science Museum. The Nexon Computer Museum produced an analog-like worksheet based on the shape of a floppy diskette. In addition, the National Daegu Science Museum provides a reward by providing missions using beacons and smart watches. As such, the Korean museum gamification has only differences in the means of viewing, and consists of basic game elements such as challenge, competition, achievement, and reward [2]. Currently, Korean museums only have differences in viewing methods such as videos, VR/ARs, and it is difficult to find fun elements. The purpose

Manuscript received: October 15, 2020 /revised: November 19, 2020 / Accepted: December 03, 2020
Corresponding Author: msj8086@kw.ac.kr
Tel:+82-01-7753-8086, Fax:+82-2-916-4751
Author's affiliation: Institute of Information Technology Kwangwoon Univ., Korea

of the museum is to give visitors the fun of visiting the museum and to make it an impressive memory by taking advantage of the museum's unstructured environment and non-formal education.

2. Related Work

Since 2013, Nexon Computer Museum has been conducting gamification of museum education through the worksheet ``NCM.exe Adventure Guide". In addition, the National Daegu Science Museum introduced a smart watch-based mission-based learning content in 2016 to conduct gamification of the museum.
First, the Nexon Computer Museum produced a worksheet called "NCM.exe Adventure Guide" for children, based on the shape of a floppy diskette, a digital storage device of the 90s that they have never encountered. This is planned and produced and sold directly by the museum, and the viewers who purchase it will participate in the mission “Find the missing keyboard piece!” in the worksheet. As players solve missions within the worksheet, they find the hidden keyboard fragments for each floor. Complete the sentence by filling in the blanks for each keyboard color, and the mission is completed, and a given gift is given as a reward. Nexon Computer Museum's "NCM.exe Adventure Guide" is designed to help students solve quizzes related to computer history through games. Participants can learn computer history as they answer the quiz in the worksheet. Since the quiz is designed to induce a visit to the museum, participants can lead learning. The unused floppy diskette-like worksheet also has an educational function that allows participants to indirectly experience the old media that the participants have not experienced through its visual elements. In order to develop the game, the museum recruited a children's advisory group, asked for advice regarding the "NCM.exe Adventure Guide", and also sought development plans. Children who participated in the advisory talked about making a part of the appreciation guide. “The theme is an index notebook. Although there were problems, it was good to have made it myself [5].” He showed his satisfaction with being actively involved in program development. On the other hand, the National Daegu Science Museum uses a smart watch platform to provide educational games for museums to children, the main visitors. This game, a bearer co-planned and produced by National Daegu Science Museum and distributor Pin Play, is a game where players participate by using a smart watch that communicates with a beacon installed in the exhibit. The game is played by team play, and randomly presents one of the five questions installed on the exhibits in the museum. The quiz is a total of 125 questions, and upon completion of the mission, players will receive a certificate of completion. In the direct interaction process of receiving and solving quizzes by accessing the exhibits where beacons are located in the museum, viewers can lead and learn about the exhibits. The reward factor in the game, in which the participant enters the game result on the smartwatch to obtain a certificate, is intended to immerse the participant in the process of solving the quiz. Jeon Hae-jin, director of the National Research Institute of Daegu Science Museum, said, “The introduction of educational contents suitable for the purpose of the Daegu Science Museum centering on experiential mission education provides fun to visitors and provides learning and play experiences at the same time and looks forward to it." The purpose of introducing the smart watch program was announced. In addition, Moon Kyung-soo, director of Pin Play Content, who developed the program, said, “We will show a system that can continuously upgrade to the content that viewers want by analyzing the data collected through mission-type experiential education.” He mentioned the continuous development of the smart watch program [6].

'Storytelling' is a compound word that combines 'Story' and 'telling'. This means that the perspective is shifted around “telling,” which is the utterance itself, not the text-based “story” [7]. The dictionary meaning of storytelling is The action of telling stories, an activity that tells stories. It implies that the text itself is not conveyed as it is, but conveys a personal meaning to the method of communication. It is noteworthy that choosing a delivery method based on the source of the story has become more important, and it can completely change the value of the story. The delivery method has changed dramatically with the times. When the sense of acceptance is expanded by combining elements of image, motion, and interaction based on text, the audience's pleasure increases accordingly. This is why the game, which is a complex delivery method that can stimulate all levels of sense, is a content that has strength in terms of amusement. In other words, the story that becomes a resource becomes the basic foundation, and a secondary creation is created depending on the platform through which it is distributed. The key feature of storytelling delivered through

the game is the process of variation in which the player's actions are added to the provided story. If the act of seeing, hearing, and imagining in a given situation is the essence of the pleasure of reading the story, in the process of directly intervening in the imagined worldview, the inmate can become the subject participating in the world of the story [8].

Questo is a mission of discovery where tourists teleport in a fictional story, the main character. This mission has various quests that can be enjoyed in 40 cities in Europe, and there are quests suitable for each country, such as 'Unravel the Secrets of Dracula's Castle and Escape' and 'Be the Wizard of London to Protect People'. In the course of solving the quest, it was configured to make it easy to understand the European tourist area by moving through the GPS and solving the related missions and viewing the missions and stories. It also provides services to discover new places in addition to famous tourist spots around the world while discovering hidden stories [9].

3. Gamification MDA+

Defining the gamification structure based on the gamification theory, there are interesting aesthetics that allow users to ultimately feel fun and satisfaction, and dynamics that keep the progress and constant interest. In addition, game mechanics for dynamics experience and interfaces that allow users to immerse themselves in the game can be defined as the basic structure of gamification. This structure was referred to as MDA+ by borrowing the header. The order was presented in the direction of the ultimate in the sphere in the order of Mechanics, Dynamics, and Aesthetics presented several times in the previous study. Interface is marked with + for convenience of concept and memory added to the existing theory. In <Table 1>, based on the MDA+ gamification structure, the components suggested in various gamification theories have been reclassified to be more clearly understood [10].

	Bunchball (2010)	M2 Research (2012)	Deterding (2012)	Lee Dong-yeop (2011)	Park Sangjin (2006)
Mechanics	points, level achievements, leader boards	transparency, competition, score, infinity, leaderboard	badge, level, leaderboard, time limit, limited resources, order	rules, rank/status, reward/use	quests, events
Dynamics	(virtual) rewards, competitions, gifts/donations	prize, SNS, Share/Forward, UGC, Strategy, feedback	-	manipulation/management, benefits/mileage, correlation	control, chat rooms, inventory
Aesthetics	self-expression, altruism	self-education, self-expression, satisfaction	-	-	background story
Interface	-	-	-	-	Use layout, typography, and metaphor

<Table 1> Reorganization of components by theory according to MDA+

As a result of reclassifying the components of the gamification MDA+ proposed in this study and the existing theory, the gamification structure and components have a somewhat unclear boundary. And it is found that the combination of two upper factors has a complex characteristic that affects the other higher factors. However, it was judged that it is meaningful to subdivide the structure and elements rather than integrating them in order to help the progress of thinking by specifying factors to be considered when performing gamification. <Table 2> summarizes the results presented by reclassifying in <Table 1> and presents elements that have similar meanings to overlapping elements between theories.

MDA+	Component
Mechanics	points, levels, quests, leaderboards, badges, status, transparent rules, time limits, limited resources, order, infinity
Dynamics	(virtual) rewards, gifts/donations, sharing/delivery, UGC, feedback, manipulation/management
Aesthetics	self-expression, altruism, self-education, satisfaction, background story
Interface	Use layout, typography, and metaphor

<Table 2> Gamification components according to MDA+

Finally, based on the MDA+ presented in this study, various gamification application cases were analyzed. Through this, it is possible to grasp what element the case is specifically equipped with gamification MDA+. Also, by comparing, it was possible to more clearly understand the necessary components when designing gamification according to MDA+.

MDA+	NCSU	GVSU	NIKE+	Khan Academy	MGM
Mechanics	time limit submission method score	quest point leader board time limit	quest point leader board badge	quest point level badge infinity	quest level badge
Dynamics	problem solving process reward answer released (feedback)	reward/strategy scanner (operation) FAQ formation	reward share/forward	knowledge map learning graph	reward
Aesthetics	fun self-education heuristic activity	heuristic activity self-education satisfaction	background story	self-education satisfaction	story theme self-education fun heuristic activity
Interface	metaphor to find and hunt things	design aspects of the application	design aspects of the application	design aspects	design aspects of the application

<Table 3> Application examples of gamification inside and outside the museum analyzed according to MDA+

As shown in <Table 3>, most gamification application cases are based on quests and points, and you can see that they are motivated by a reward system. In NCSU, the use of hunting metaphors stood out compared to other services using only a design interface. GVSU can play as a strategy by inserting clues found by the user in the course of performing the quest of the application. And after completing the quest, the FAQ was formed, and it was characteristic to form Dynamics that did not end with one-time quest execution. In the case of NIKE+, unlike other cases, there is a background story, and the fact that users can enjoy running as if they were the main characters of the story formed new aesthetics. The characteristic of the Khan Academy is that it has dynamics that stimulate users' learning needs with knowledge maps and learning graphs as well as rewards. MGM focused on the story theme. The biggest feature is that it has interesting aesthetics so that users can feel various fun and satisfaction by providing stories of various themes.

4. Proposal System

4.1 System Overview

In this section, we propose a story gamification that provides information of the museum in collaboration with the museum in the existing gamification, and shows the story theme related to the museum by combining with story elements based on the collected data. [Figure 1] is the outline of the system configuration proposed in this paper, and is composed of External Sites Layer, Proposed System Layer, and

Using Layer. In addition, the proposed system layer consists of a data collector, data base, gamification process provider, MGP (Museum Gamification Processing), and MGM viewer. And the following is a description of the components of each layer.

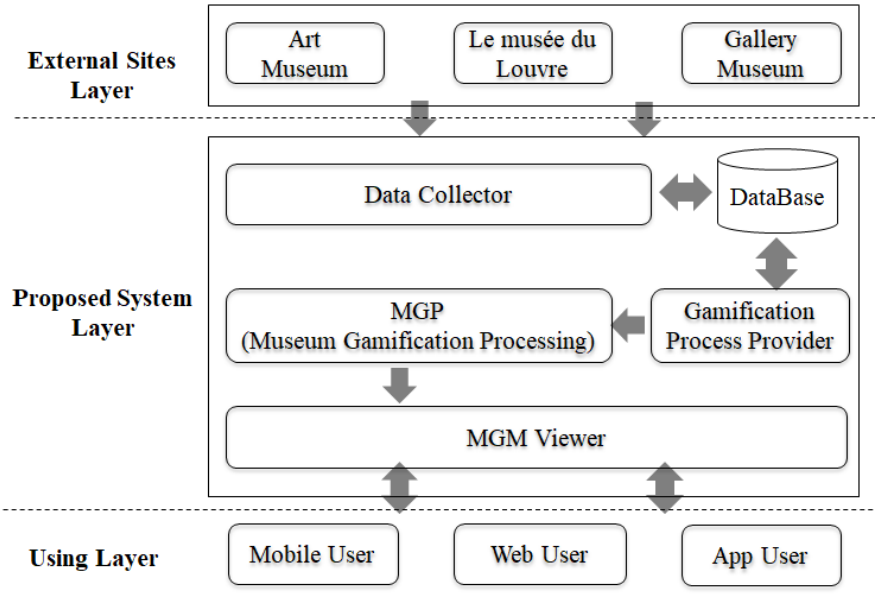

Figure 1. Proposal system composition (Museum Gamification Using Story)

- **Data Collector**: The Data Collector collaborates with museums, art galleries, and exhibition halls to collect information from external sites and collect it in a database.

- **Gamification Process Provider**: The Gamification Process Provider provides story information related to museum information collected in the database.

- **MGP (Museum Gamification Processing)**: MGP (Museum Gamification Processing) shows the game story that fits the museum based on the provided story information that fits the museum information, and the MGP shows the finalized story to the viewer.

- **MGM Viewer**: MGM Viewer outputs and shows the story with serviced gamification on various user screens.

The following is a flow chart of the museum gamification app.

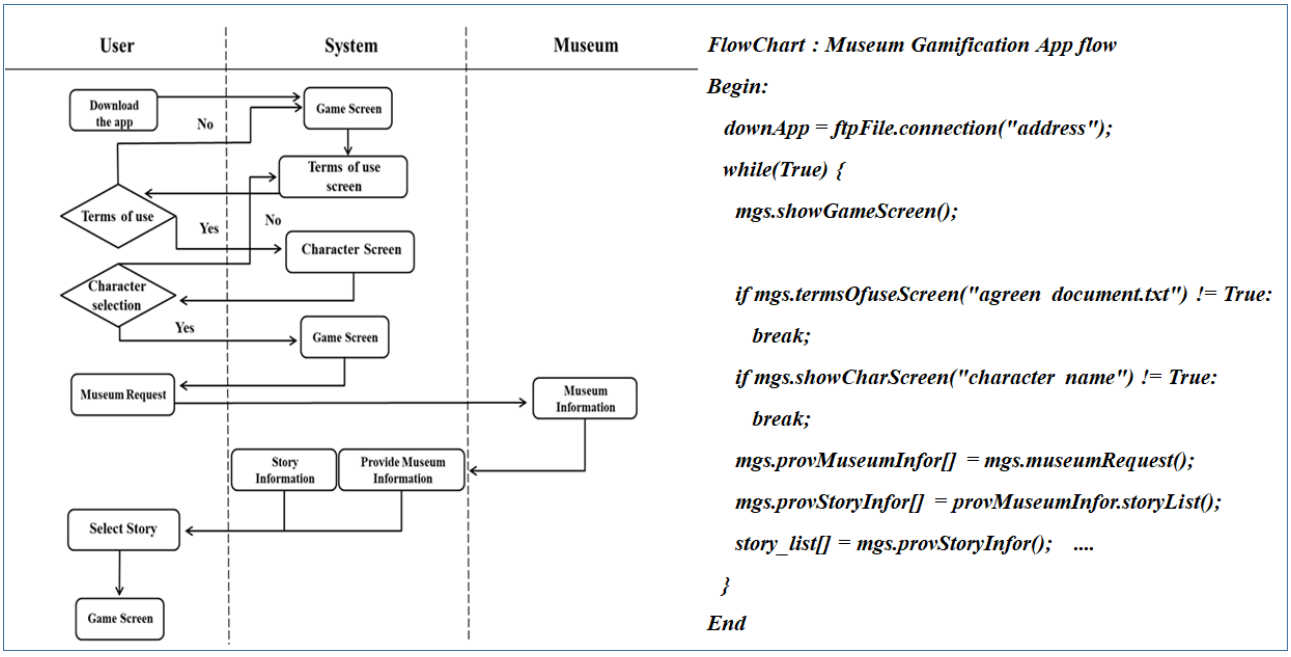

Figure 2. Proposal system flow

When the user downloads the app, the system shows the game screen, and the user selects the terms and conditions and character. When the user requests museum information from the game screen, the museum brings the museum information to the system. The story information in the system is combined with the museum information to show the user a story related to the museum, so that the user directly selects the story and the game proceeds.

4.2 System Story Algorism

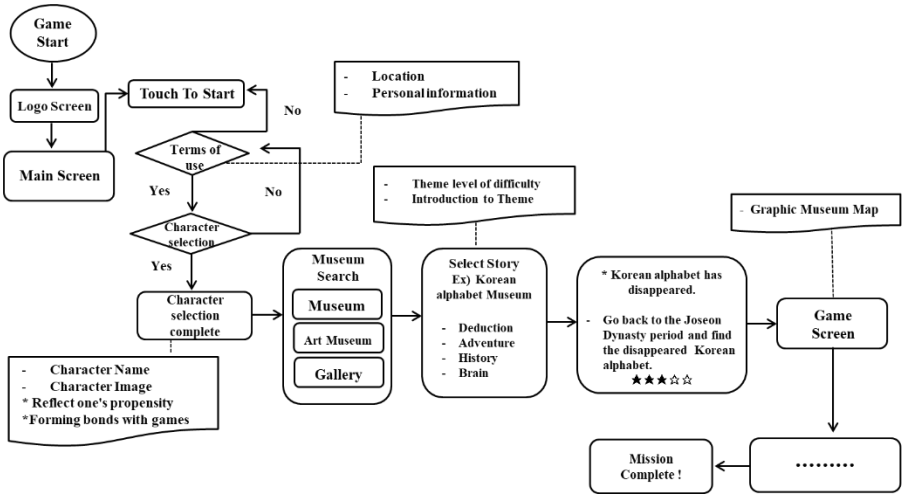

Figure 3. Proposal system Story Algorism

The story algorithm in this paper agrees to terms and conditions and selects characters before starting a museum game. In terms of terms and conditions, you agree to terms and conditions for personal information and location, and in character selection, select names and character images. Choosing a character helps to form a bond with the game and reflects the spectators' tendencies. Next, select a museum type to find it yourself, or search by museum name. For example, by searching the National Hangeul Museum, you can

select the story you want, such as adventure, mystery, history, and brain. You can also select the difficulty level yourself and enjoy a game that suits your level. If you choose an adventure from the story, a short story will appear, "Go back to the Joseon Dynasty, and find the missing Korean alphabet" on the theme of "Hangul disappeared." In addition, the difficulty level can be expressed as a star to directly select the difficulty level. Finally, the game story is selected and the graphic museum map can be viewed on the game screen, making it easier for visitors to locate the exhibit.

5. Application example

This paper utilized gamification and applied story elements to gamification. This application example shows the process of implementing museum gamification based on a story.

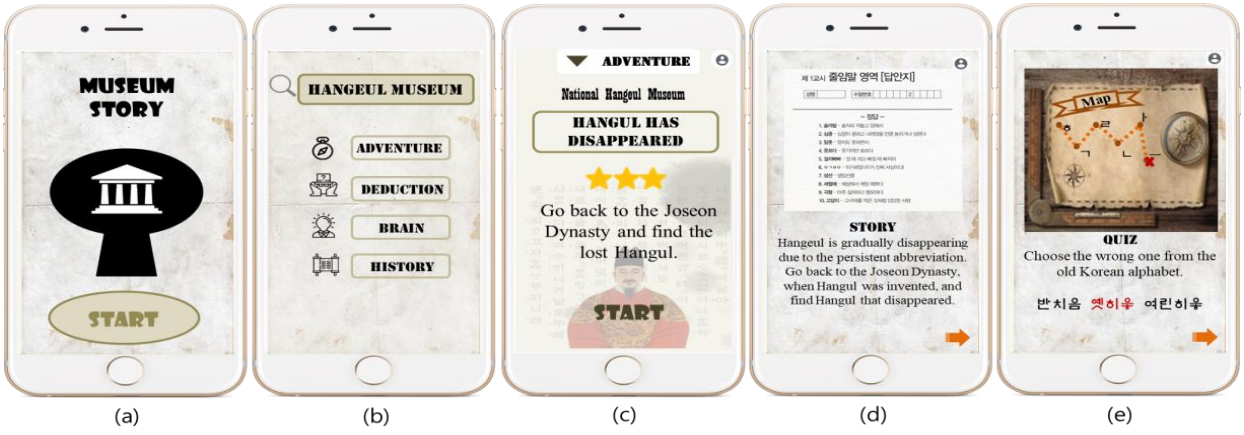

Figure 4. Mobile Apply Example

Figure 4. is made with basic structure information such as concept and design. (a) is the app's game start screen. (b) Choose a story theme related to the selected museum. (c) Check the plot for the selected adventure story. (d) is the content of the last selected story “Hangul is gradually disappearing due to its abbreviation. Go back to the Joseon Dynasty and find the missing Korean story” and solve the adventure mission step by step with a mini map on the game screen. If you solve the mission in (e), you get a consonant or vowel in Hangul to create a word by combining consonants and vowels, and you arrive at the final destination based on the hints given by the word and the game ends.

6. Conclusion

Gamification is used in various fields such as education, healthcare, corporate marketing, culture, and art. The museum also utilized gamification to preserve, collect, and display old historical relics, archaeological data, and other academically meaningful materials, and extend them to the viewer's experience beyond the purpose of social education and academic research. This paper proposed museum gamification using story elements. The proposed system was combined with story elements based on existing gamification. Currently, museums have a variety of viewing methods, but there is a problem that they are not fun. However, the museum gamification proposed in this paper provides a fun element to visitors and helps them to be memorable. Among them, by adding story elements to gamification, you can play games with the content you want, providing personalized game services. The services provided by the system proposed in this paper are as follows. First, provide a story. By providing stories, visitors can focus on the contents of the museum. Second, it is possible to select the difficulty of the game. Because the age range of visitors varies, you can play a game that suits you regardless of whether you are a child or an adult. Third, customized stories are provided for each type of museum. Because each museum has a different story, you can enjoy a variety of

games. The museum gamification proposed in this paper is expected to occupy a large portion as a factor utilized by referring to Questo. However, if it is composed of a reward-only design without a story, tourists will not be able to understand the concept of the museum. Unlike the general museum program, the methodology proposed in this paper will contribute to the development and execution of a program with gamification in various tourism fields. In conclusion, efforts will be needed to strike a balance between story and game elements. Therefore, as a future study, it would be an ideal museum if you balance the story with game elements and study other functions as well as educational functions.

7. Reference

[1] Kwon, J. "The development of educational and/or training computer games for students with disabilities", Intervention in School and Clinic, Vol. 48, No. 2, pp. 87-98, 2012., https://doi.org/10.1177/1053451212449738
[2] So-Hee Son, Seo-Yun Min, Dong-Eun Lee "A Case Study of Museum Gamification in Korea and abroad", Journal of Korea Game Society 18(2), 2018.4, 109-120(12 pages)., https://doi.org/10.7583/JKGS.2018.18.2.109
[3] Kim, T.W. and Werbach, K. "More than just a game: Ethical issues in Gamification", Ethics and Information Technology, Vol. 18 No. 2, pp. 157-173, 2016. , https://doi.org/10.1007/s10676-016-9401-5
[4] Jungmin Kwon "Guidelines for Serious Game Museum Exhibits", Journal of Korea Game Society 19(4), 2019.8, 119-138(20 pages)., https://doi.org/10.7583/JKGS.2019.19.4.119
[5] http://blog.nexoncomputermuseum.org/
[6] Jeong, Jae-Hun, "Daegu National Science Museum, First Introduction of Education Program Based Smart Watch", ETNEWS, 2016.09.30, http://www.etnews.com/20160930000230
[7] KwangWook Kim, "The Research on the Conception of Storytelling",The Society of Korean National Language and Literature, Vol.41, pp249-276, 2008.
[8] Ko, Jay, Kang, Hyosoon "The Study on Web Game based on Game Storytelling focused on Three Kingdom", Journal of Korea Game Society 15(1), 2015.2, 55-61(7 pages)., https://doi.org/10.7583/JKGS.2015.15.1.55
[9] https://www.questoapp.com/about
[10] Seonghun Kim, Seonmin Hwang "A Study on Curation Service in University Library based on Gamification MDA+", Journal of Korean Library and Information Science Society 50(3), 2019.9, 261-291(31 pages)., https://doi.org/10.16981/kliss.50.201909.261