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## A Study on Puzzle Game-based Learning Content for Understanding Mandala

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### Abstract

*This study proposes the development of 'Mandala 37', a puzzle game based content that learns the principles of 37 Honored Ones within the Diamond World Mandala. The proposed game is a new type of learning content that combines the development process of 37 Honored Ones with the characteristics of the puzzle game. It aims to increase the understanding of Buddhist content by inducing learners' interest and increasing their concentration. Learners can learn and understand the principles of the emergence of 37 Honored Ones naturally through the rules of the game.*

*This study introduces the implementation process of the proposed game and explains how learners perceive the principle of 37 Honored Ones within the Diamond World Mandala through the game.*

**Keywords:** 37 Honored Ones, Buddhist Ceremony, Diamond World Mandala, Buddhist content, Game-based content

## 1. INTRODUCTION

Mandala is a Structuring of Buddha and Bodhisattva on a sacred altar, representing Indian Buddhist ceremony that expresses the truth of the universe. Esotericism, a type of Buddhism, uses mandalas as a way of expressing truth. Mandala is an image of the scriptures how the monk perceives union with the universe through religious experience [1]. Mandala originated from ancient Indian esotericism and started with religious colors and it has been handed down for a long time in the pursuit of the absolute good of human beings. Mandala is gaining more attention in modern times as a way of self-reflection or self-healing through the understanding of self-centeredness and essence, the understanding of the world. Many contents are developed in the field of education and psychotherapy using mandala. However, they are based on drawing activity, not basic understanding of mandala [2-3]. This study attempts to connect the mandala with the game as a way to enhance the understanding and accessibility of Buddhist cultural contents.

Young people in the 21st century have been in a computer environment since their birth, and most students have grown up with games. Recently, with the development of smart technology and mobile communication technology, the platform where the game is implemented is also very diverse, such as online, mobile, and network, and the growth rate of the game industry is continuously increasing. Games have a negative perception that they are violent and a waste of time, but they have many advantages such as interest, immersion, immediate feedback, motivation, active participation, creativity through problem solving, and collaboration through interaction. By connecting learning with the positive aspects of games, it can be used as a good educational tool for the 21st century. In order for learners to construct their own knowledge, above all, the

active participation of learners must be premised. Learners need to be aware of the value and usefulness of learning and have fun in order to participate actively in learning. One way to encourage learners' voluntary participation is with games. Existing learning contents produced based on texts or simple images have a disadvantage in that learners feel bored and lose their concentration, and their concentration can be reduced. Game-based learning (GBL) has been studied to solve the problems of the existing learning contents [4].

Game-based learning is a method of applying the characteristics of the game to the learning content to induce learners to learn naturally while playing the game, and increase the efficiency of learning by inducing the learner's interest and improving concentration. This study applies the advantages of game-based learning that can induce learners' interest. Through the puzzle game, we developed 'Mandala 37', a game based learning content that allows learners to understand the development process of 37 Honored Ones within the Diamond World Mandala. Although there are differences between individuals, the mandala puzzle matching activity gives the user a concentration of activity, confidence in the activity, and a sense of creative achievement. As the game is played, the understanding of the mandala increases and the player gains psychological and emotional stability.

The configuration of this study is as follows. In section 2, mandala and game-based learning are described. In section 3, the development process of 37 Honored Ones within the Diamond World Mandala is described. In section 4, the design and principles of the game 'Mandala 37' are described. Finally, the conclusion and future research are described in section 5.

## **2. BACKGROUNDS**

### **2.1 Understanding of the Mandala**

First, in Buddhist terms, Mandara can be interpreted in two ways. One is to achieve the essence based on etymological interpretation. The other refers to the Buddhist scriptures that visualize the principles of systematically unifying the Buddha, the Bodhisattva that seeks them, and the various forms of faith in their outer space. Mandala is a circular wheel filled with the essence of the universe or the life of the universe, and forms a geometric figure with the cosmos of harmonization and order.

Etymologically, the Sanskrit 'Mandala' is a combination of the suffix 'La' with the meaning of 'Manda', which means the center or the essence or the heart. After all, mandala is a compound word that gets the center or essence. In the Indian literature, such as Mahabharata, the term mandala is sometimes used to mean book chapters, divisions of land, etc. But in Buddhism it was used mainly in Esoteric terms. Mandala represents Indian Buddhist art. It is a guide to the enlightenment that the Esoteric ascetic seeks through meditation to gain the great vitality of Mahāvairocana, the core of the universe. From the word mandala, many people associate images of blooming lotuses and bodhisattvas placed on eight leaves.

To understand a mandala, one must understand its characteristics. Common characteristics of Buddhist mandalas, including Esoteric mandalas, include: The first is the concept of space domain place. Everything is connected to each other and one. The second characteristic is pluralism. If only one Buddha is depicted, it is not a mandala. The various Buddhas and Bodhisattvas must exist together to be called Mandala. Third, it has a center or a focus. For mandalas must have a sacred position corresponding to a Buddha in the center. The last characteristic is harmony. According to the concept of pluralism, mandala components are arranged in an orderly way around the center.

The most important feature of the mandala is that it is based on a circle. Many religious symbols, including mandalas, have used circles. This means that the circle is a contemplation instrument of mind and wants to move to the center of the circle, which symbolizes the Infinite Absolute. Mandala represents the essence of human life beyond the dimension of painting drawn in a circle, and contains a view of the world. Through the circle of mandalas, it enables the unity of various dimensions in our minds and enables us to see the minds and to be a channel for wisdom. Therefore, many studies have been conducted to make people forget about their

anxieties and worries through art activities using mandalas, and to be able to balance their emotions and mental states to obtain vitality and inner fullness [5-8].

## **2.2 Game-Based Learning (GBL)**

Game-based learning is learning that learners reach their learning goals through games that contain educational content independently, without direct involvement by the instructor. Games naturally provide learners with immersion and fun, creating an interesting learning environment and giving them a natural and educational effect in the process of playing. Games for game-based learning must have learning goals, have fun, and be motivated [9-11]. In particular, recent researches have shown that digital game-based learning provides continuous interest to learners and strengthens motivation to induce active participation, thereby enhancing learning perception along with natural review effects [12-14].

The interaction effect of the game improved the logical thinking ability of learners not only in the high-learning group but also in the low-learning group. Prensky has defined generations that use the digital languages of computers, video games, and the Internet as generations N or D, signaling the emergence of a different kind of generation from previous generations. Unlike their predecessors, these generations are very familiar with video and cyberspace. Especially for them, computer or online games are more than just entertainment or entertainment. Because of this, everyday life in cyberspace has a huge impact on education and learning [4]. Research on cognitive performance improvement by game-based learning has been mainly conducted from healthy young adult samples. Bruce D. Homer has been shown to be effective in training cognitive skills by proposing custom video games to support the development of high school students' executive functions showed that digital games were effective for improving the attention of students for Brazilian elementary school students [15-16].

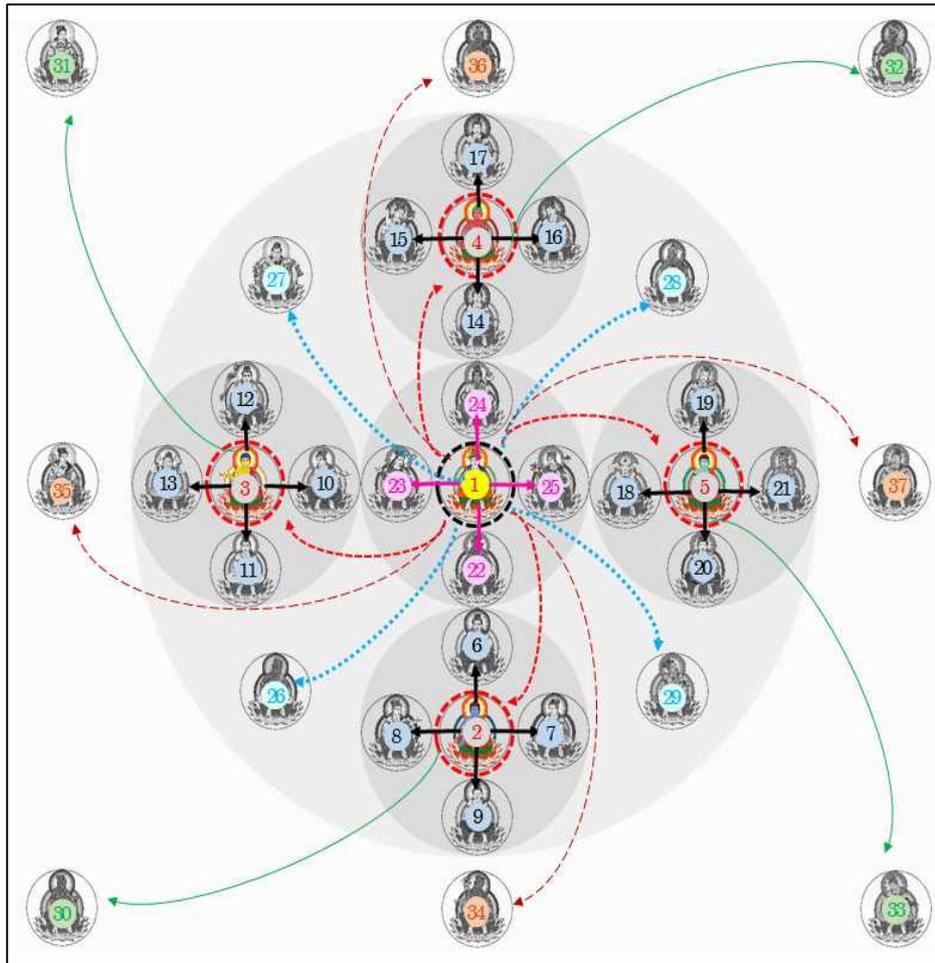
This study provides game-based learning contents to learners to create a natural environment for understanding mandalas. The learner will be able to play the proposed game actively and become naturally aware of the principles of the mandala and become familiar with Buddhist content.

## **3. Development of 37 Honored Ones within the Diamond World Mandala**

Mandalas symbolically represent the core ideas of Buddhism in various forms and appear in round or square forms. In Korea, China and Japan, the Matrix Mandala based on Mahāvairochana Sūtra and the Diamond World Mandala based on Vajraśekhara-sūtra are generally known. Among the many mandalas, the Diamond World Mandala, which is dealt with in this study, is a structure in which various Buddhas and Bodhisattvas are systematically drawn in the middle of a square or a circle. It has such characteristics as dynamism, stereoness and activity. The Vairocana Buddha is the highest level that an ascetic gets through a Mandala. The 37 honored one within the Diamond World Mandala are built in interactions of the Vairocana Buddha and the four Buddhas (Akṣobhya Buddha, Ratnasambhava Buddha, Amitābha Buddha, Amoghasiddhi Buddha) located in four directions (East, South, West, and North). The four Buddhas characterize the four characteristics of the Vairocana Buddha's good heart, enlightenment, and perfectly tranquil. Each Buddha in the four directions develops four Bodhisattva each, and they all become 16 great Bodhisattvas. As a result of interaction between Vairocana Buddha and 4 Buddhas, 37 honored ones form within Diamond World Mandala.

The Diamond World Mandala reveals 37 Honored Ones, major Buddhas and Bodhisattvas. Each 37 Honored Ones represents a variety of symbolic meanings according to color, orientation, behavior, related objects, and gestures. In addition, the form is three-dimensional and is a symbol formed as a result of the interaction between the endless action and the reaction between the Buddhas and the Bodhisattvas. The Diamond World Mandala has 32 Bodhisattvas emerged from the interactions between the central Buddhas (Vairocana Buddha, Akṣobhya Buddha, Ratnasambhava Buddha, Amitābha Buddha, Amoghasiddhi Buddha) to form 37 Honored Ones. It develops with characteristics of diffuseness neutrality and interoperability.

Among the characteristics of 37 Honored Ones within the Diamond World Mandala, diffuseness is an attribute that shows the spread of the 4 Buddhas and 32 Bodhisattvas outwardly [17]. The 37 Honored Ones means 5 Buddhas, 16 Great Bodhisattvas, 4 Perfection Bodhisattvas, 4 Inner offering Bodhisattvas, 4 Outer Offering Bodhisattvas, and 4 Attraction Bodhisattvas. Figure 1 shows the numbered sequence of locations and developments of 37 Honored Ones within the Diamond World Mandala.



**Figure 1. The development of 37 Honored Ones within the Diamond World Mandala-I**

The highest level that the ascetic gains through mandara is represented by the Vairocana Buddha. The development of 37 Honored Ones within the Diamond World Mandala consists of an interaction between Vairocana Buddha and 4 Buddhas in 4 directions (East, South, West, and North). First, 4 Buddhas (Akṣobhya Buddha, Ratnasambhava Buddha, Amitābha Buddha, Amoghasiddhi Buddha) are appeared in 4 directions from the Vairocana Buddha. Each of the 4 Buddhas deployed unfolds 4 Bodhisattvas in 4 directions, each of which consists of 16 Great Bodhisattvas. 4 Buddhas again deploy 4 Perfection Bodhisattvas to the Vairocana Buddha, and the Vairocana Buddha deploys 4 Inner offering Bodhisattvas in response. Each 4 Buddhas unfolds 4 Outer offering Bodhisattvas to reward the Vairocana Buddha's response. The Vairocana Buddha also unfolds 4 Bodhisattvas of attraction in response to 4 Outer offering Bodhisattvas. As a result, the interaction between the Vairocana Buddha and 4 Buddhas expands 37 Honored Ones within the Diamond World Mandala. Figure 2 details the names and relationships of 37 Honored Ones within the Diamond World Mandala.

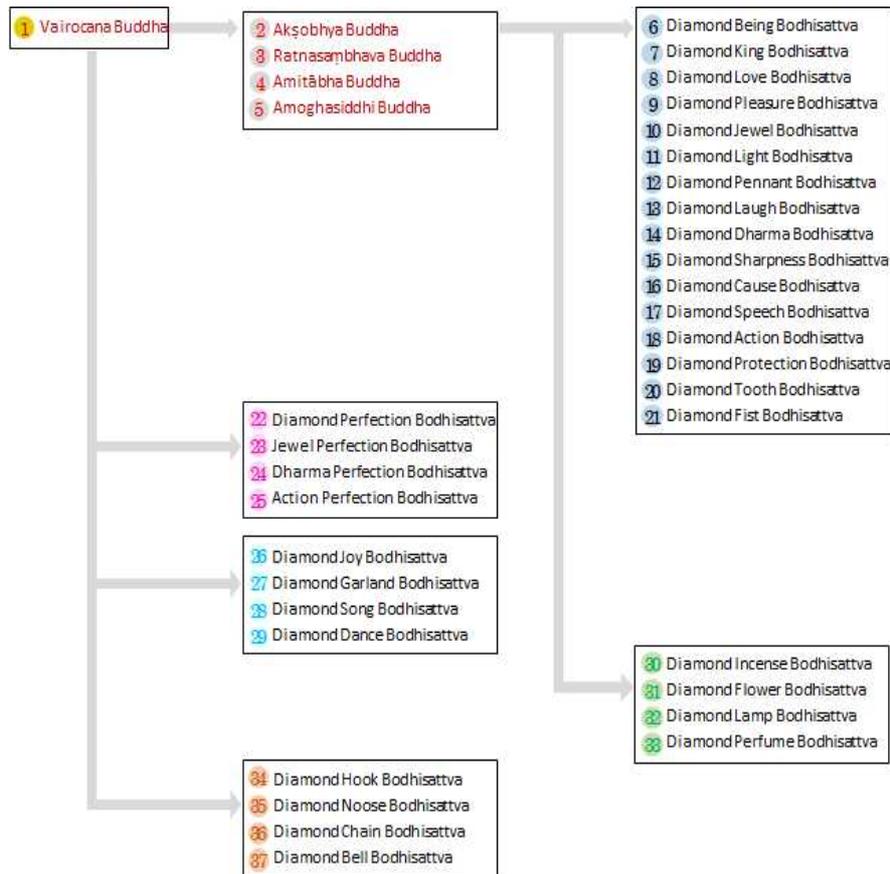


Figure 2. The development of 37 Honored Ones within the Diamond World Mandala-II

## 4. IMPLEMENTATION Of ‘Mandala 37’

### 4.1 Design of Game Scenes

Based on K. Kim's research, this study proposes a puzzle game-based learning content focusing on the understanding and immersion of 37 Honored One s[17-18]. ‘Mandala 37’ is a puzzle game that applies the principle of finding the correct location of 37 Honored Ones to the method and rules of the game. In order to induce the learner's interest and get effective self-directed learning effects, we had a process of designing a game scenario suitable for the learning subject. Figure 3 shows the flowchart you configured to determine how to organize each game scene.

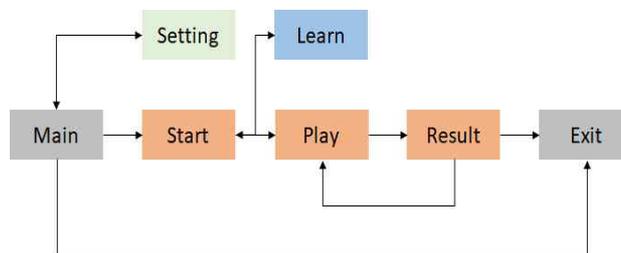


Figure 3. A flow chart of ‘Mandala 37’

Game scenes were specifically designed based on the designed flowchart in figure 3. Figure 4 shows the screen configuration of the game 'Mandala 37'. The screen consists of three parts, the game stage(① in Figure 4) to play the game directly, the message stage(② in Figure 5) to show the progress of the game, and the time limit(③ in Figure 6) to increase the game's immersion. In the game stage, circular tiles are arranged for the learner to play the game. The message stage displays the status information for notifying the progress of the game while the learner plays the game, and a score, which is one of the functions for inducing the learner.

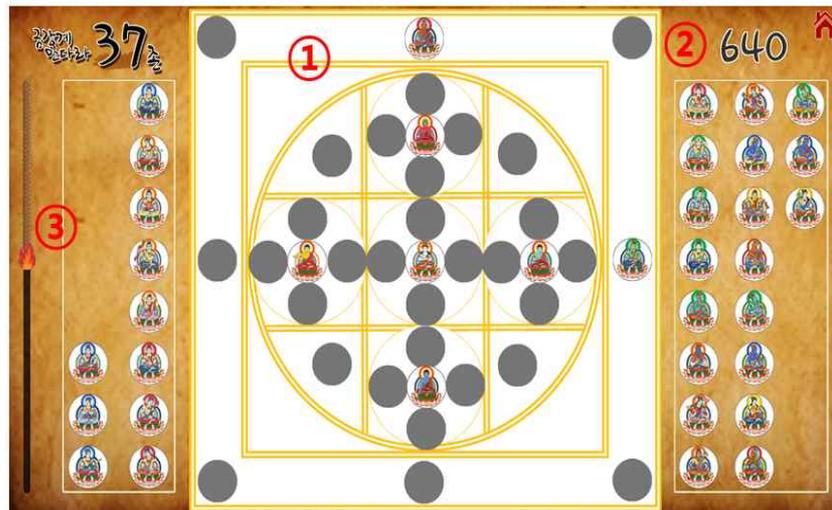


Figure 7. Screen configuration of the game 'Mandala 37'

We chose Richards's 'Winds Over The World' as the background music to be played during the game. This background music helps the user to enjoy the lasting peace while listening to the wind.

## 4.2 Implementation and operation of the game

'Mandala 37' is a game-based learning content that combines the principles of finding the correct location of 37 Honored Ones with the existing puzzle game format. The circular tiles listed in the game are images of 37 Honored Ones, and the placement of the tiles is determined by the stage of the game. The game consists of two levels. Level 1 is a step for user learning. Therefore, at level 1, the tiles are fixed in order according to the development order of 37 Honored Ones. A user who successfully completes Level 1 has a chance to move to Level 2. Level 2 can be repeated constantly, the position of the tiles is formed randomly, the difficulty is naturally increased. Random placement of tiles is a useful tool that allows users to continue playing new games without feeling bored. By repeating this series of steps, the user finally has a complete understanding of the evolution of 37 Honored Ones. Figure 4 shows the overall flow of the game scenes.

This game uses the score as an effective way to perceive 37 Honored Ones. Feedback on the accuracy of the learner's play was displayed so that the learner could check it. This score is used to determine the duration and stop of play. As the learner plays the game, the score increases when the tile is placed in the correct position, otherwise the score decreases. 'Mandala 37' was implemented using Unity 2018.1.4f1 on a desktop PC with Windows 10.

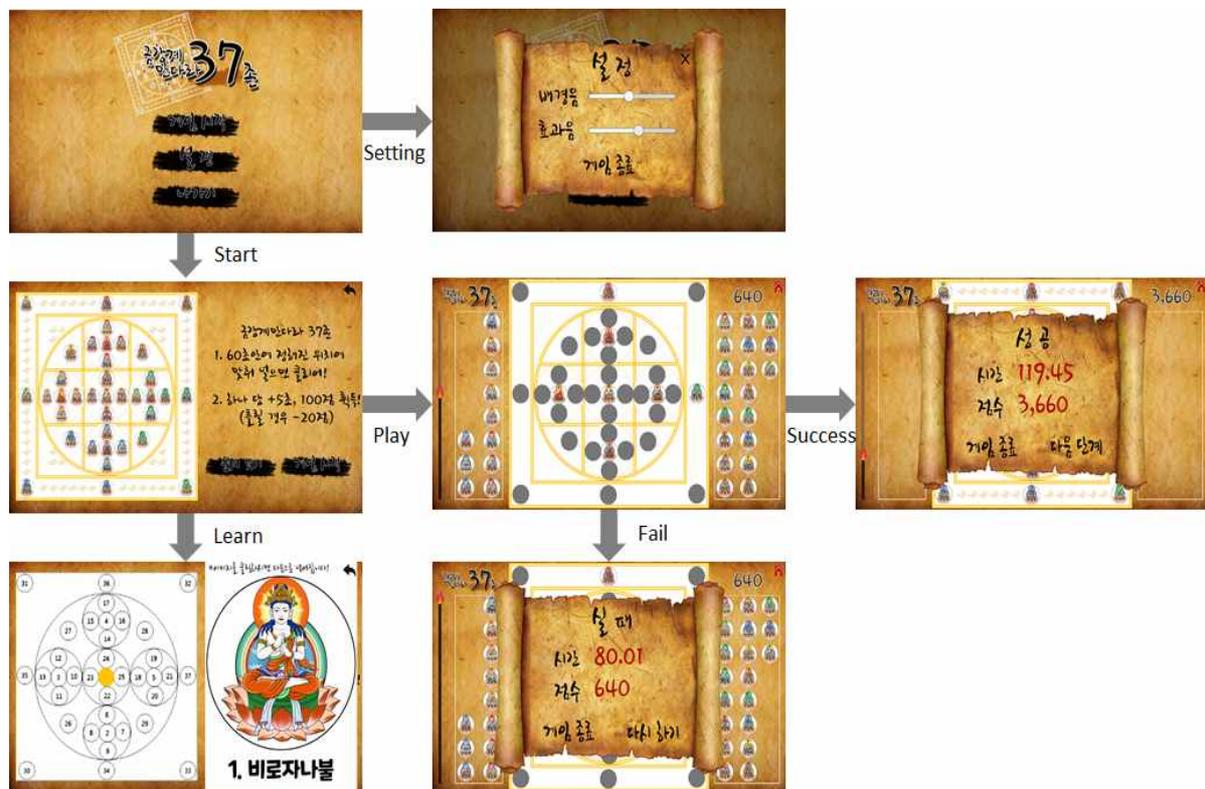


Figure 8. The overall flow of the game scenes in 'Mandala 37'

## 5. CONCLUSION & FUTURE WORK

Mandalas represent the phenomena of the universe and the essence of human life, and the basic form of mandalas exists anywhere in the nature and surrounding environment in which we live. This study attempts to explore and apply the basic theory of mandala as an educational medium that seeks to integrate body and spirit, perception and practice. To this end, we proposed 'Mandala 37', a game-based learning content that understands and learns the principles of 37 Honored Ones within the Diamond World Mandala. This content allows the user to learn the contents through the game, and to enhance the interest and concentration through the advantages of the puzzle game to immerse in the learning. In the future, we plan to test the learner's group and verify the measured results in order to verify the significant effect through game-based learning. It will also develop a mobile version of the current PC game that is easily accessible.

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