

# Disaster prevention learning by Karuta game to facilitate understanding relations between unsafe and safe behaviors

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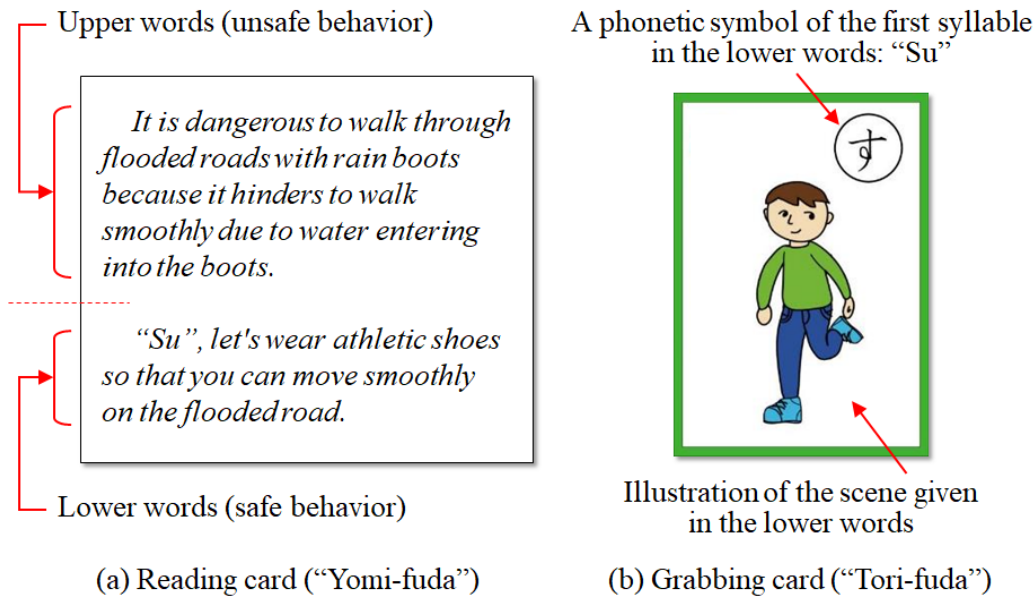
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**Abstract:** There have been various disaster prevention learning methods based on gaming, such as simulation games and card games, to help acquire the knowledge of disaster prevention. Evacuation behaviors include mutually related unsafe and safe behaviors, and such behaviors are needed to be understood as pairs because it is often difficult to guess one type of safe or unsafe behavior from another type. For example, if knowing the danger of wearing rain boots during flooding as unsafe behavior, it is not easy to guess how to behave in such situation to ensure safety. Therefore, it is important to understand the relations between unsafe and safe behaviors so that evacuation behavior can be acquired as practical knowledge. In this study, we propose a disaster prevention learning method that employs a traditional Japanese card game called Karuta game in order to facilitate understanding the relations between unsafe and safe behaviors. Karuta games consist of two types of cards: reading cards and grabbing cards. The reading cards are given with phrases on unsafe and safe behaviors respectively in the upper and lower words, and each grabbing card is depicted with a scene of taking safe behavior. In this way, disaster prevention knowledge is represented in the contents of Karuta game, taking the relations between unsafe and safe behaviors into account. Karuta game is played by two or more players with the help of a reciter, and the reciter randomly takes a reading card from the deck and reads it aloud. The players race to grab or touch a grabbing card that matches the meaning of the reading card. As a preliminary evaluation of the Karuta game, we conducted user observation in an evacuation drill in cooperation with elementary school children. As results, it was observed that children paid attention to the differences between unsafe and safe behaviors, and their accompanied guardians also understood the idea of unsafe behaviors.

**Keywords:** disaster prevention learning, gaming, card game, evacuation behaviors

## 1. Introduction



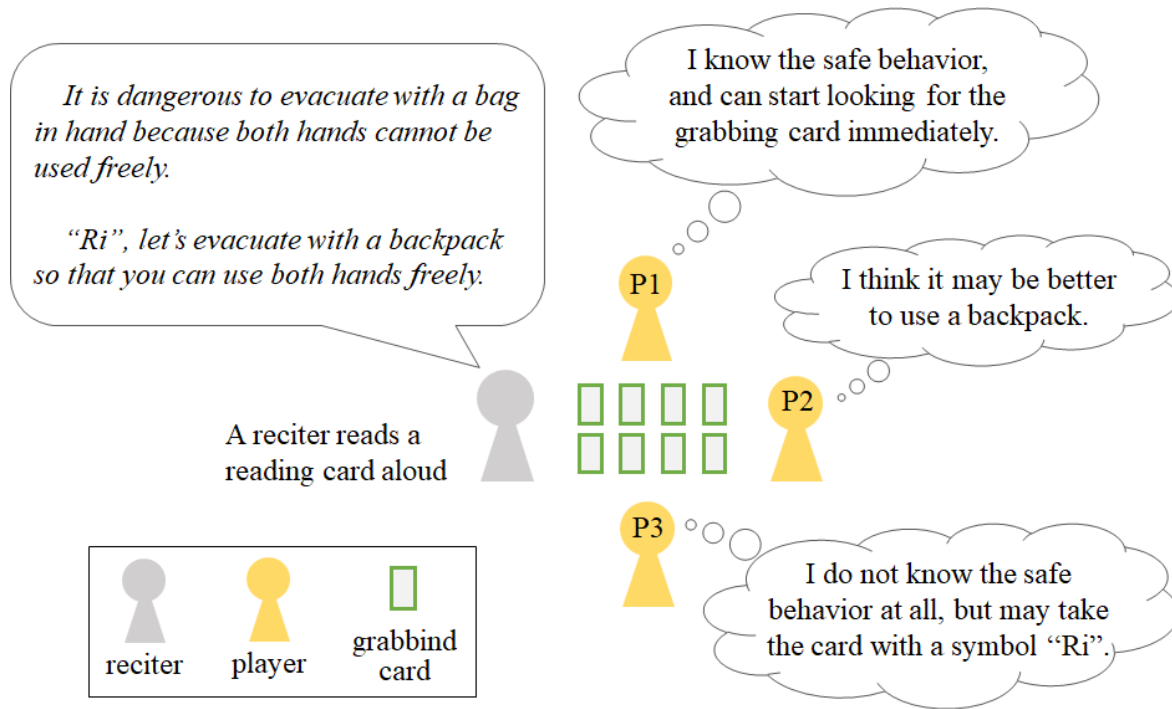
**Figure 1.** Two types of cards used in the Karuta game for disaster prevention learning

Recent years, damage caused by heavy rainfall disasters has occurred frequently in Japan (Ushiyama, 2007), and various tools for disaster prevention education (e.g. hazard map, video learning materials, simulation games (Kobayashi et al., 2008) and card games (Yamori, 2007)) have been developed to help people acquire knowledge of safe evacuation in cases of flooded disasters. The disaster prevention knowledge is difficult to acquire through disaster experience because opportunities to face disasters are accidental and sometimes fatal. A gaming approach to disaster prevention learning is then promising because it is possible to simulate such undesirable situations that learners should not experience or cannot easily encounter (Duke, 1974). In whatever way or manner, games that require sufficient target knowledge are not easy for beginners to keep playing since the lack of basic knowledge may hamper achievement of better outcome and hinder motivation for learning. In contrast, card games that simply rely on color, number or symbol will be easy for beginners to play. However, if the goal or rules of a game has nothing to do with the knowledge in the domain of learning, players cannot acquire any actual knowledge. Therefore, it is necessary to invent a game such that the more a player understands the target knowledge to learn, the more advantageous the player can play the game.

In disaster prevention learning, it is important to understand the correspondence relation between unsafe and safe behavior as a pair because it is often difficult to take safe behaviors adequately only knowing either safe or unsafe behavior. In this study, to facilitate understanding the relations between unsafe and safe behaviors, we employ a traditional Japanese card game called Karuta game (Aiba, Fujiwara & Byrd, 2009) (Ogawa & Tsuchiya, 2014).

There are two types of cards in Karuta game: reading cards ("Yomi-fuda") and grabbing cards ("Tori-fuda"). Reading cards consists of two parts: the upper words ("Kaminoku") and the lower words ("Shimonoku"). The scene or situation described with lower words in a reading card is illustrated in the corresponding grabbing card, on which a phonetic symbol ("Hiragana") of the first syllable in the lower words appears as an indicator symbol. Karuta game is usually played by two or more players with the help of a reciter, and all the grabbing cards are spread face up on a flat surface. The reciter randomly takes a reading card from the deck and reads it aloud. The players race to grab or touch a grabbing card that matches the meaning of the reading card, referring to the illustration of the phrase and the indicator symbol in the lower words as clues. This read-and-grab step is usually repeated until no grabbing cards remain.

In the Karuta game for disaster prevention learning (Figure 1), reading cards are given with phrases on unsafe and safe behaviors respectively in the upper and lower words in the case of flood



**Figure 2.** Scene of playing Karuta game.

disaster, and each grabbing card is depicted with a scene of taking safe behavior. In this way, disaster prevention knowledge is represented in the contents of Karuta game, taking the relations between unsafe and safe behaviors into account. Note here that there are some evacuation situations where unsafe behaviors cannot be inferred readily with only knowledge of safe behavior. For example, there is nothing wrong with wearing rain boots when it is raining. However, if people evacuate wearing rain boots when flooded to your knee's height, there is a possibility that they cannot move smoothly due to water entering into the boots. Thus, it is important to understand the relationships between unsafe and safe behaviors. In this study, we propose Karuta game to facilitate understanding of the relationships between unsafe and safe behaviors, and present a preliminary report on the user observation of the game playing by local residents participated in an evacuation drill.

## 2. Karuta game as a learning environment





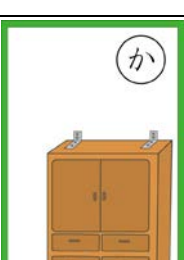
The proposed Karuta game provides reading cards where unsafe behaviors are expressed in upper words and safe behaviors are expressed in lower words. Grabbing cards include illustrations of the scene and situation described with the lower words and a phonetic symbol of the first syllable in the lower words. Karuta game is played with a reciter and more than two players. The players race each other to take a grabbing card with illustration of the safe behavior recited.

Figure 2 depicts a scene of playing the Karuta game where a reciter is reading out a card. If a player knows the evacuation knowledge being recited, the player can expect the safe behavior to be given in the lower words while reading the upper words. In such cases, the player can start looking for the grabbing card earlier than those who cannot expect the lower words. Therefore, players can play more advantageously than others by understanding safe behaviors in relation to the corresponding unsafe behaviors. However, even if players do not know the relations between unsafe and safe behaviors, they can take grabbing cards merely relying on an indicator symbol. Therefore, it is possible for beginners to have opportunities to consider the relationships between unsafe and safe behaviors while participating into the Karuta game.

According to the dual coding theory (Paivio 1986), presenting information in both verbal form and images assists learners with processing of complex material, and enhances recognition and recall of the information. In our Karuta game approach, the reading cards are used to present evacuation

behavior in verbal form, and the grabbing cards provide scenes of safe behavior as images. Following the rules of the game, players pay attention to the correspondence between the illustration on grabbing cards and recited evacuation behavior. In addition, since it is often difficult to distinguish items presented with a similar situation, there may be possibilities of confusing safe behaviors with unsafe behaviors under the same evacuation situation. In this Karuta game, to prevent mistakenly remembering unsafe behaviors as safe behaviors, safe behaviors are expressed as the illustration of grabbing cards and the lower words of reading cards, while unsafe behaviors are expressed only in the upper words of the reading cards without imagery representation.

**Table 1: Examples of Karuta cards used for the user observation**

Knowledge of evacuation	Reading card		Grabbing card	
	Upper words (unsafe behavior)	Lower words (safe behavior)	The first syllable	Illustration with an indicator symbol
(a) Evacuation with athletic shoes	It is dangerous to walk through flooded roads with rain boots because it hinders to walk smoothly due to water entering into the boots.	“Su”, let's wear athletic shoes so that you can move smoothly on the flooded road.	Su (す)	
(b) Evacuation with a backpack	It is dangerous to evacuate with a bag in hand because both hands cannot be used freely.	“Ri”, let's evacuate with a backpack so that you can use both hands freely.	Ri (り)	
(c) Early preparation of evacuation materials	It is dangerous to prepare what you need just before the evacuation because you may get delayed escaping.	“Mo”, let's prepare evacuation materials in advance so that you can act quickly at the time of disaster.	Mo (も)	
(d) Evacuation to a tall building	It is dangerous to go outside for evacuation when flooding water depth is above the knee because it is difficult to walk.	“A”, let's wait for help in a nearby tall building so that you can avoid getting stuck during evacuation.	A (あ)	
(e) Fixation of furniture	It is dangerous not to fix bookshelves and chests to the wall or ceiling because they may fall down by heavy shaking in the earthquake.	“Ka”, let's fix furniture to the wall or ceiling with metal fittings so it cannot fall down by earthquake	Ka (か)	

### 3. User observation

As a preliminary evaluation of the Karuta game, we conducted user observation in an evacuation drill for local residents. The drill was held at the gymnasium of an elementary school in Takatsuki city, Osaka Prefecture, Japan on November 29, 2015. In this user observation, evacuation knowledge in cases of earthquakes and floods were extracted from an official disaster prevention booklet published by Takatsuki city, and 12 pairs of reading and grabbing cards were prepared. Some of the Karuta cards are shown in Table 1. Each Karuta game was played about for 5 minutes. Most of the participants were children between the ages of 5 to 10 years as show in Figure 3. As results of the user observation, it was found that some children in lower grades of elementary school started to look for



**Figure 3.** Scene of playing the Karuta game in an evacuation drill.

grabbing card while reading the upper words. This means that if players understand evacuation behavior correctly they can recall safe behavior from the corresponding unsafe behavior recited in the upper words. This is a remarkable feature as a learning environment because players or learners can recognize if they understand the behavior correctly or not by themselves in the course of playing the Karuta game. It was possible for a kindergarten child who cannot read Japanese phonetic symbols to participate in the game looking for illustrated scene of safe behavior on grabbing cards. In addition, it was confirmed that participants understood unsafe behavior in relation to safe behavior, from the following comments by parents of participated children: "Although I have thought all along it is better to wear rain boots to go outside in a heavy rainy day, I surprised to know we need to wear athletic shoes when we evacuate in the case of flood disaster."

On the other hand, when players try to find a grabbing card for the evacuation with a backpack, there were two cards in which the illustration of backpack was included: "Evacuation with a backpack" (Table 1 (b)) and "Early preparation of evacuation materials" (Table 1 (c)), and it was confusing for some players to identify a correct grabbing card. This kind of duplication may happen because the same object can appear repeatedly in different scenes if the object is what people need at the time of evacuation. The duplication, however, can be resolved when the lower words are being read because players can identify the correct card with reference to an indicator symbol on each grabbing card.

### 3. Concluding remarks

In this study, we proposed Karuta game to support learning the differences and mutual relations between unsafe and safe behaviors. On the basis of the user observation and our experiences, the proposed idea is likely to work as a game-based environment for learning the disaster prevention knowledge. In the user observation, we assumed that a session for the Karuta game was performed once for each group of participants. However, to enhance the learning effect furthermore, it would be

useful to repeat the session for each participant changing the members because learning effect depends on not only the understanding level of the player but that of the other members. It is also our future study to develop a learning support tool or application based on the proposed Karuta game so that many people can be engaged in the disaster prevention learning by themselves.

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