

## Vegetation Interaction Game: Digital SUGOROKU to Learn Vegetation Succession for Children

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**Abstract:** We developed a Vegetation Interaction Game that supports children's immersive and interactive playing of a simulation game about vegetation succession. To examine the effectiveness of the game, we conducted experimentation in an elementary school. The results of game interaction analysis showed that the game could support children immersively playing and learning regarding vegetation succession.

### Introduction

Although previous studies have dealt with simulation games (Barab & Dede, 2007; Squire & Klopfer, 2007), there is no simulation game that dealt with vegetation succession in natural environment. This issue discusses the development of the Vegetation Interaction Game and reports the results of evaluation of this game.

### Development of Vegetation Interaction Game

The Vegetation Interaction Game is a digital sugoroku board game that works with Adobe AIR (Adobe Integrated Runtime). Figure 1 is the main window of the digital game; it shows the face of the sugoroku board. Fig. 2 shows six pieces of each plant. The size of the sugoroku board was set at 1024\*768 pixels. The surrounding part is the grid area of the sugoroku board, and there are a total of 48 grids. The central part houses the following components of the game: there is an event cards area (figure 1-a), a direction window to move pieces (fig 1-b), and a visualization window to show vegetation succession according to the progress of the game (fig 1-c). We set the event cards to correspond to some kinds of disturbances that could possibly occur in the Mt. Rokko region. There are six kinds of event cards: two large disturbances—tree cutting, landslide; two small disturbances—wild boar, pine weevil disease; no disturbances—fair weather, rain. These are programmed to influence vegetation succession.

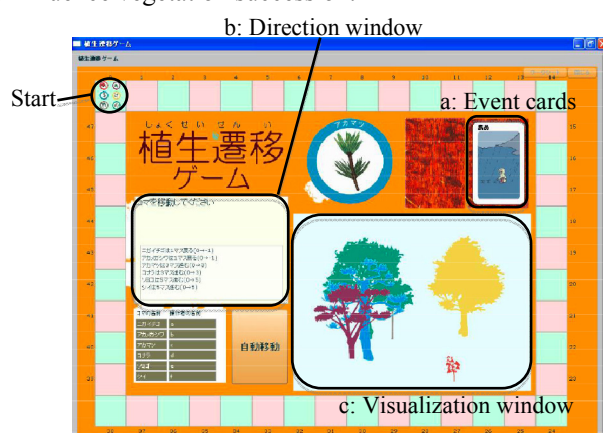


Figure 1. Main Window.

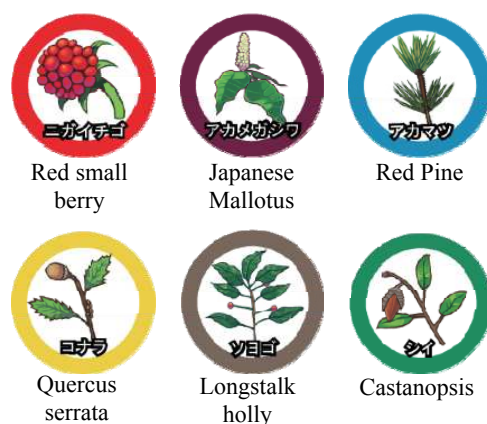


Figure 2. Plant Pieces.

Six players can participate in one game. Each player handles one piece. Players draw event cards, one at a time, by clicking in turn. When a plant piece advances ahead on the board grids, it implies that the plant is dominant in that particular environment. Each piece is to be moved by the number of grids that the current event card indicates. If more than one piece takes the same position on the grid, they will be moved along the grids as indicated by the rules governing the interaction between plants. A game finishes when all event cards are drawn.

## Method

**Subject:** The subjects were 17 sixth grade children (12 years old) in Japanese elementary school. One of the three groups was randomly selected, and interactions of the group were analyzed. The group consisted of six members: three boys and three girls. In addition, five of the six children correctly answered 70% of the total items in game understanding test.

**Data and Analysis:** To obtain analysis data, the group's statements and actions were video recorded. The recorded data were then transcribed and used for analysis. The transcript was divided into units marking the transitions of the events and plant interaction in game playing. In each unit, we examined children's utterances to clarify whether children were acting as the plants. The children were regarded as "acting as the plants" when their utterances indicated that they empathized with the plants. For example, when the event card "landslide" was drawn, ("Red small berry" holder said) "I did it!!" When interaction between the pieces occurred, ("Red pine" holder said) "Oh no, 'Longstalk holly' came!! I have to return."

## Results

The total number of units was 32 and they are arranged in chronological order in Table 1. The gray-filled bar means that "acting as the plants" utterances were made by the child who holds the plant's piece in the unit. In 30 of 32 units, "acting as the plants" utterances occurred. Additionally, there are a total of four units (No. 3, 19, 21, and 32) in which all the children made utterances of "acting as plants". However, the total number of the unit in which 'acting as the plants' were made by fewer than three children, which means fewer than half the member of one group, was 13 units. Looking at this data in greater detail, of these 13 units, 8 units were 'transition of the events,' and 5 units were 'plant interaction.' In addition, total number of units was 22. Of these 22 units, 22 units were 'transition of the events,' and 10 units were 'plant interaction.' So it means that the unit in which 'acting as the plants' were made by fewer than three child accounts 50% in total number of 'plant interaction' units, and 36% in total number of 'transition of the events.'

Table 1: Results of game interaction analysis.

Children	Units															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Red small berry																
Japanese Mallotus																
Red Pine																
Quercus serrata																
Longstalk holly																
Castanopsis																

Children	Units															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Red small berry																
Japanese Mallotus																
Red Pine																
Quercus serrata																
Longstalk holly																
Castanopsis																

Grayed bar fill: 'acting as the plants' utterances were made by the child who held the plant's piece in the unit

## Conclusion and Future Task

To make an improvement for this task, following strategy is thought to be effective. In the scene of plant interaction, the power relationship between plants arises, which means when a piece of a child's plant make interaction with other child's plant, it will conquer the other child's plant or will be defeated by the other child's plant. If such kind of power relationships are shown more obviously on the game interface, it could support children got immersive in the phenomena of plant interaction. Future work on this project would involve attacking above improvement, and developing a game that support children's immersive playing and understanding of vegetation succession.

## References

- Barab, S., & Dede, C. (2007). Games and immersive participatory simulations for science education: An emerging type of curricula. *The Journal of Science Education and Technology*, 16(1), 1-3.
- Squire, K., & Klopfer, E. (2007). Augmented reality simulations on handheld computers. *Journal of the Learning Sciences*, 16(3), 371-413.

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