Evaluation of a Mobile Plant-Identification System to Support the Study of Vegetation Succession

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Abstract: The authors developed a smartphone-based *Pocket Plant Guide* to support the outdoor learning of vegetation succession, and evaluated the utility of this device by administering a questionnaire to 35 elementary school children. The results indicated that the *Pocket Plant Guide* not only functions as a supportive learning tool, but also offers a user-friendly interface.

Keywords: Mobile system, outdoor learning, vegetation succession

Introduction

The authors have developed the *Pocket Plant Guide*, a smartphone-based, mobile system for plant identification [1] [2]. The *Pocket Plant Guide* provides accessible information about six indicator plants for outdoor learning into vegetation succession. These plants have been selected on the basis of findings from research into vegetation succession conducted in the Rokkozan region of Hyogo Prefecture in Japan. A digital game using a similar group of indicator plants has previously been developed, in order to enhance vegetation succession studies (The Vegetation Game: An Vegetation Succession Game). However, as this game is situated within a virtual world, it has encountered problems in terms of real-world relevance. The *Pocket Plant Guide* addresses these problems, by providing information that focuses specifically on the six indicator plants in outdoor learning, and thus complements the information obtained from the game.

In this study, we evaluated the *Pocket Plant Guide*, concentrating on the ease of use of its interface and its effectiveness as a learning support, by administering a questionnaire to elementary school children.

1. The *Pocket Plant Guide*

The *Pocket Plant Guide* is designed to operate on an iPhone/iPod touch. It provides graphic and verbal information about the characteristics of leaves for the six indicator plants used in the vegetation succession game, so that the user can identify these plants in the field. Figure 1 shows the home screen of the *Pocket Plant Guide*. If you touch the icon of a particular

tree, such as the *konara* (a species of oak indigenous to Japan), a black-and-white image of the corresponding leaf will be displayed. When you touch the "see characteristics" button in the bottom right corner, the screen will switch to an image with comments, as Figure 2 illustrates. The "select plants" button in the bottom right corner of this next screen returns the user to the home screen.

Figure 1: Home Screen

Figure 2: Image with Comment

2. Evaluation of the *Pocket Plant Guide*

2.1 Method

Subjects: 35 sixth-grade elementary school children (aged between 11 and 12)
Use of the *Pocket Plant Guide*: The students first played the vegetation succession game, and then spent half a day outdoors, searching for plants featured in the game. The *Pocket Plant Guide* was used for reference during the outdoor learning.
Tasks and procedures: We set two tasks. The first focused on plant identification. In order to investigate the extent to which the system influences the subject's knowledge of plants, we showed the subjects images of the leaves of the six plants featured in the *Pocket Plant Guide*, before and after usage of the system, and elicited the name and characteristics of each plant. The second task focused on user evaluation. In order to evaluate the accessibility of the user interface and the benefit of knowledge provided by the system, we asked the subjects to complete a questionnaire after they used the system. The questionnaire required them to respond to 17 statements with one of the following options: "I strongly agree," "I somewhat agree," "I somewhat disagree," and "I strongly disagree." Both tasks were performed using questionnaires, which took around 15 minutes to complete.
Timing: The evaluation took place on October 22, 2011.

2.2 Results

2.2.1 Plant Identification Task

The responses to the task of identifying and providing characteristics for the plants featured in the *Pocket Plant Guide* before and after usage of the system were evaluated according to the Wilcoxon signed-rank test. The results showed that the number of times a plant was correctly identified and described increased significantly after implementation of the system (median of before 1.0, median of after 11.5; Z=-5.24; $p < .01$).

2.2.2 User Evaluation Task

Table 1 illustrates the trends discovered in the subjects' responses to each question. We examined the trends by first separating the four choices into two groups, consisting of positive and negative responses, and then calculating the deviation using the Fisher statistical significance test. The results showed that there were significantly more positive responses than negative responses to 16 out of the 17 statements ($p < .01$). There was no significant difference in responses to Statement 13.

Table 1: Evaluation of the *Pocket Plant Guide*

	TS	STS	DQTS	DTS
01: It was fun to use the *Pocket Plant Guide*.**	25	10	0	0
02: I was absorbed while using the *Pocket Plant Guide*.**	14	19	2	0
03: The *Pocket Plant Guide*'s screen was easy to see.**	32	3	0	0
04: It was good to have buttons at the bottom.**	26	8	1	0
05: The buttons were of the right size.**	24	8	3	0
06: It was easy to switch from the screen to select plants to the screen where the image of the plant's leaf is shown.**	33	2	0	0
07: It was easy to switch from the screen that showed an image of the plant's leaf to the screen that showed the image with comments.**	34	1	0	0
08: It was easy to return to the screen to select plants from the screen that showed an image with comments.**	25	0	0	0
09: The screen showing the image of the plant's leaf was of the right size.**	23	8	4	0
10: The screen showing the image of the plant's leaf with comments was of the right size.**	22	10	3	0
11: I looked at the screen showing the image of the plant's leaf repeatedly.**	33	2	0	0
12: I looked at the image of the plant's leaf with comments screen repeatedly.**	21	13	0	1
13: It was easy to find the leaf of the plant I was looking for.	2	13	15	5
14: I compared what was described on screen showing the image of the plant's leaf with comments with the real leaf of the plant.**	19	13	3	0
15: I compared what I observed on the real plant with what was shown on the *Pocket Plant Guide*. **	21	9	5	0
16: The *Pocket Plant Guide* was useful in outdoor learning. **	28	5	2	0
17: I want to investigate other forests using the *Pocket Plant Guide*. **	26	8	1	0

N=35. ***p* <.01 TS: Think so, STS: Somewhat think so, DQTS: Don't quite think so, DTS: Don't think so

3. Conclusion

The results demonstrate that the *Pocket Plant Guide* is an effective aid for students in identifying indicator plants for vegetation succession studies. The *Pocket Plant Guide* has been evaluated positively because it is fun to use and easy to operate, and is an effective support in outdoor learning. However, the responses to the statement "It was easy to find the leaf of the plant I was looking for" did not show a positive tendency. In this regard, it is necessary to improve both the information content and the interface provided by the *Pocket Plant Guide*. Additionally, it is important to consider the importance of teacher intervention in learning activities that make use of such a system.

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References

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