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Development and Evaluation of a User Adaptive Kanji Learning System Using Computer Graphics

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Abstract: This paper describes the development and evaluation of a user adaptive Kanji learning system. In order to make our already developed learning systems more adaptive for users so as to obtain the learning effects, in this study, we used the Japanese Kanji characters as e-learning content displayed on our computer system, evaluated the system performance and analyzed the learning effects. After introducing our newly developed learning system into an elementary school, we got good results through a questionnaire survey. In addition, we found out the improvements to this new system.

Keywords: Kanji, E-learning, Learning system, Computer graphics

1. Introduction

In recent years, the personal computers (PCs) and internet devices have been introduced into the elementary schools to allow school education using the PCs to be fully carried out. The advanced computer has made it possible to use computer graphics as learning materials. It seems effective that the use of computer graphics to display e-learning content arouses the user's interest in content and makes the user understand much more about it with the computer graphics introduced in making visual effects.

Matsushita et al. have been developing the teaching materials using computer graphics [1] and the learning system using computer graphics to display e-learning content [2]. The learning system displays a user adaptive learning content to increase the learning effects. The user can select e-learning content that he/she desires on this system to make questions automatically at random for the selected content.

In order to make our already developed learning systems more adaptive for users so as to obtain the learning effects, in this study, we used the Japanese Kanji characters as e-learning content displayed on our computer system, evaluated the system performance and analyzed the learning effects.

This paper presents the development outline and construction of a user adaptive Kanji learning system. Furthermore, it describes the evaluation of system performance and the analysis of learning effects through a questionnaire survey after the introduction of system into an elementary school.

2. Kanji Learning System

2.1 System outline

A user can select a Kanji character that he/she wants to study on this system to make questions at random for the selected Kanji with different readings of onyomi and kunyomi. All school children are able to select a Kanji character regardless of the school year. The Kanji learning system can cope with both onyomi and kunyomi readings that a Kanji character has.

2.2 System construction and screen structure

This system consists of HTML, JavaScript and PHP. The web browser interface is built in the system. The computer graphics animations on the screen were created using the POV-Ray software [3]. Figs. 1 and 2 show the system construction and the screen structure, respectively.

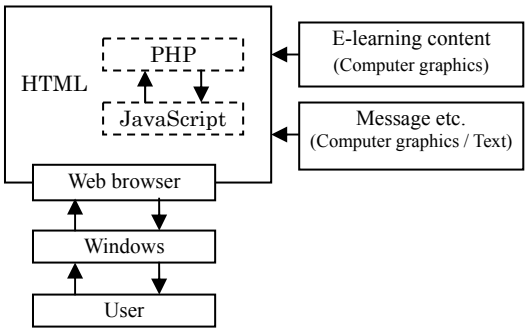


Fig.1 System construction

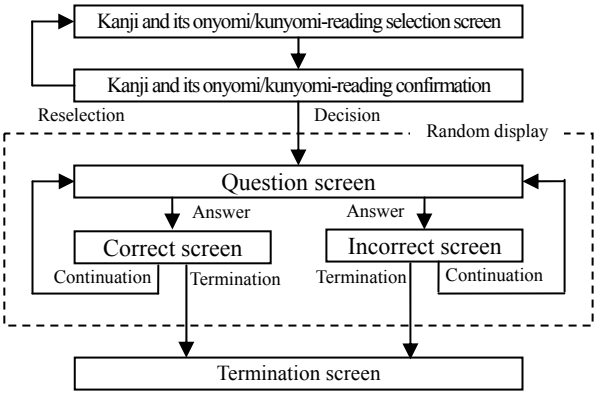


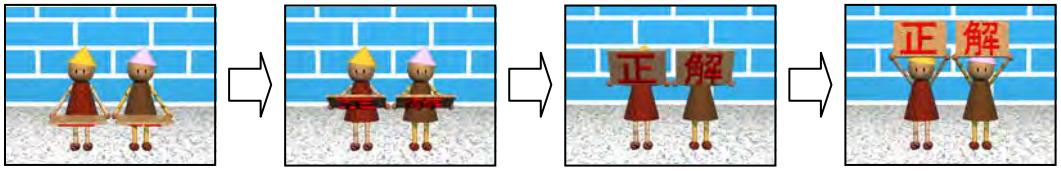
Fig.2 Screen structure

3. System Operation and Screen Transition

Actuating the system displays the Kanji and its onyomi/kunyomi-reading selection screen (Fig. 3 (a)). On this screen, the user selects a Kanji character and its onyomi/kunyomi readings (onyomi-reading study or kunyomi-reading study) that he/she wants to master. On the Kanji and its onyomi/kunyomi-reading confirmation screen, the user checks if the selected Kanji and its onyomi/kunyomi readings are completely correct. The question screen (Fig. 3 (b)) displays the selected Kanji (the correct answer screen) and the other Kanji (the incorrect answer screen). The user has to choose between two answers for a question and successively click either answer that he/she considers correct. After the user answers the question, the correct or incorrect answer screen shows the corresponding computer graphics animations (Fig. 3(c)).

(a) Kanji and its onyomi/kunyomi-reading selection screen

(b) Question screen



(c) Computer graphics animations on correct/incorrect answer screens

Fig.3 Screen transition

4. introduction and evaluation of system

We introduced our newly developed system on trial in class of an elementary school and conducted a questionnaire survey on the evaluation and analysis of this system. The subjects were 48 fourth-year students. In this experimental method, each student used one PC and accessed the system through the internet. The questionnaire survey was carried out using the five grade evaluation system, with 5 being the best, and the free writing system. This was an anonymous survey. Tables 1 and 2 show the questionnaire items and the results of questionnaire analysis in the five grade evaluation system, respectively.

Table.1 Questionnaire items in five grade evaluation system

- Was the system easy to use? (Question 1)
- Was the system interesting to operate? (Question 2)
- Were the animations of system good? (Question 3)
- Was a lesson in the system proper? (Question 4)

Table.2 Questionnaire average scores and top 2 response rates in five grade evaluation system

n=48	Question 1	Question 2	Question 3	Question 4
Average scores	4.71	4.60	4.79	4.69
TOP 2 response rates	96%	94%	98%	94%

According to the results of this questionnaire survey that the top 2 response rates (the ratio of "5" or "4" scored in the questionnaire items) were very high in the five grade evaluation system, our updated system is considered to be effective in learning with the computer graphics animations on the screen. In the questionnaire survey using the free writing system, we obtained a lot of positive opinions for the Kanji learning system to be used for studying. We also received plural students' opinions that they are not good at Kanji, but they can enjoy learning Kanji on this system and have come to like Kanji. However, the students also stated their plural opinions that they request us to provide a function for selecting the related Kanji characters at the same time and to increase the number of computer graphics animations on the screen. As above mentioned, we believe that this new system must be improved, but the use of this system enabled the user to learn Kanji effectively and to arouse his/her interest in Kanji.

5. Conclusion and Future Research

This paper has described the outline of a user adaptive Kanji learning system using the computer graphics. As the results of the questionnaire survey, it is proven that this system is effective in Kanji learning. However, we found out the improvements to the system function and to the computer graphics animations on the screen.

In future, we are going to improve the system function and enter additional computer graphics animations. We will also consider whether the system improved should be assessed.

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