

Development of a Kanji Handwriting Learning Support System with Differentiated Instruction to Dysgraphia Children

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Abstract: In this study, we have developed a handwriting learning system using the LCD pen tablet in order to help dysgraphia children to learn Kanji. Teaching materials with a handwriting interface are available on the market. However, these materials have been developed for healthy people. The degree of the writing difficulty is different for each child. Therefore, the guidance adapted for each child is necessary to teaching materials. In this research, in order to perform detailed guidance in accordance with the degree of writing difficulties, we have realized functions of handwriting learning support, as described below. Firstly, we have realized the function of practicing the character, while looking at the model. For children unable to write correctly only by looking at the form of the final character, our system includes a function to display the model along the stroke order sequentially depending on the process of handwriting. Secondly, we have realized the function of tracing a model for children who can not transcribe it. These two functions are able to use at the same time. Furthermore, our system also have a function to support handwriting learning by evaluating each written stroke automatically whether it is right order or a shape of stroke and giving feedback. Currently, we are evaluating our system in using for instruction to dysgraphia children at a special support classroom of a primary school.

Keywords: Learning Support, Kanji Learning, Handwriting, Dysgraphia

1. Introduction

The purpose of this study is development of a Kanji learning support system for dysgraphia children. Among children in elementary schools of Japan, there are some children with dysgraphia (Uno, 2004). Therefore, guidance adapted for each child is necessary to Kanji learning in elementary school. Commercially available teaching materials (The Japanese Page.com, 2013; Japanese Language Lessons: Let's Learn Japanese!, 2013) can be utilized for Kanji learning of dysgraphia children. However, these materials have been developed for healthy people and can not guide finely depending on those children.

Because dysgraphia children are not confident in handwriting itself, detailed assistance of each stroke is necessary to those children (Rosenblum, Weiss & Parush, 2004). Therefore, in this study, we have realized a system that can recognize characteristics of each stroke inputted by a LCD pen tablet and feed back the evaluation immediately. We believe these functions contribute dysgraphia children to write characters intensively while checking each stroke.

2. Dysgraphia Children

Dysgraphia is a learning disability that affects handwriting (LD OnLine, 2013). Cause of dysgraphia is estimated that there is some kind of dysfunction in the work of the central nervous system. People with dysgraphia show symptoms: difficulty in copying characters from a blackboard to a notebook and understanding punctuation marks, writing in mirror writing, and so on.

Dysgraphia do not retard a child's intellectual development. Therefore, dysgraphia children can understand learning content. However, due to a setback in handwriting which is essential to learning, those children lose confidence in learning and themselves. In addition, it is difficult to see that the setback is caused by dysgraphia. For this reason, those children tend to be thought that they do not make an effort from a teacher. Because a degree of dysgraphia is different for each child, appropriate guidance in accordance with children is necessary.

3. Kanji Learning Support System

3.1 Overview of System

On the learning system, a user writes Kanji using a liquid crystal display pen tablet. This system uses Fujitsu handwritten character recognition SDK for handwritten character recognition and Wintab SDK for acquisition of the handwriting. Describing Kanji is evaluated automatically by the system. Evaluation mode of Kanji can be selected from “easy” and “difficult”. “Easy” mode evaluates whether the shape of written Kanji is consistent with the model. “Difficult” mode evaluates the shape of Kanji and following items: “Tome” (stop at the end of stroke), “Hane” (jump at the end of stroke), “Harai” (sweep at the end of stroke), “Kousa” (crossing of two strokes), “Tozi” (closing by two strokes), and “Nagasa” (difference in two strokes length).

If a user obtains full marks, a flower circle appears on the window to improve the learning motivation. If a user make a mistake, marks shown why a mistake are displayed on wrong points. In addition, handwriting data of written Kanji can be saved and read. Time spent in handwriting, obtained marks and the status of the system at the time of marking are output as a log file. Our system includes a function to show pronunciation of Kanji during learning.

3.2 Differentiated Instruction to Dysgraphia Children

For the purpose of guidance in accordance with the degree of writing difficulties, we have implement functions of writing Kanji while looking at a model, tracing a model for children who can not transcribed it, and evaluating a stroke order automatically. Figure 1 shows that a user uses functions of display a stroke order on a model and tracing it. In addition, it also shows that a user is pointed out a wrong point because of a wrong stroke order.



Figure 1. Guidance of a stroke order using functions of showing and tracing a model

For the use of the function of writing Kanji while looking at a model, a user can select whether to display the form of the final character or a model along the stroke order sequentially depending on the process of handwriting in the model area. If a user wants to display a model along the stroke order, a stroke to write next is highlighted in green.

The function of tracing a model is implemented for children who can not transcribed it. In terms of this function, the form of the final character is displayed with a pale gray, and a stroke to write next is highlighted in green in the description area.

Functions of writing Kanji while looking at a model and tracing it are able to use at the same time. As a result, children can select teaching methods necessary for their own study. For example, children practice writing Kanji by displaying the form of the final character and using the function of tracing a model.

By using the function of evaluation a stroke order automatically, the system checks each written stroke whether it right order and a shape of a stroke. If the stroke written by a user is a mistake, it is displayed in red. Thereby, the system gives children feedback immediately.

3.3 Use in Primary School

Currently, the system is utilized for instruction to dysgraphia children at a special support classroom of a certain primary school. We intend to examine an influence of using the system on dysgraphia children by analyzing log files and handwriting data stored in the system.

4. Conclusions

In this study, we have developed a Kanji learning support system for detailed guidance to dysgraphia children. In order to perform detailed guidance in accordance with the degree of writing difficulties, the system has following functions: functions of writing Kanji while looking at a model, tracing a model for children who can not transcribed it, and evaluating a stroke order automatically.

Future works are the analysis of writing action by analyzing learning data of dysgraphia children, the grasp of a state during learning and the application of a screening test.

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