

Development of an Integrated Drill Shell “Drill-Factory”

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ABSTRACT

Some drill algorithms have been proposed by instructional design researchers until now. We developed the integrated drill shell called “Drill-Factory” for the purpose that users can make various kinds of drills easily and compare some drill algorithms. This system has four kinds of functions: editing, executing, downloading and learning. Learning function shows internal process of each item on a skeleton mode.

INTRODUCTION

A drill is one of the types of instructional materials delivered by e-learning. It is mainly used for practicing learning contents and provided often as a “quiz”.

By using quiz functions available in most of Learning Management Systems (LMSs) like Moodle^[1], there are many drills that are only to give questions, to require a learner to respond, and to give feedback, without providing such mechanisms to facilitate learning proposed in instructional design models.

Likewise, some authoring tools exist (e.g. ToolBook^[2], Hot Potatoes^[3], and so on). A drill can be made easily and set some parameters such as a shuffling the order of items, but drill algorithms are hidden from users and only single algorithm is implemented. The algorithm is also poor for the particular control of failed items.

Some algorithms have been proposed by instructional design researchers until now^{[4][5]}. It is possible to use an appropriate algorithm for different size of items, learning environments and situations. It is also possible to select and use an appropriate algorithm for different kind of learning tasks, learners and situations. However, such algorithms have not been well-known in Japan, mainly because the tools or templates are not available to incorporate drill functions into e-Learning content.

In this study, we developed the integrated drill shell called “Drill-Factory” for the purpose that users can compare some drill algorithms and are supported to make drills by themselves. The system is also aimed that users are not only provided the environment to make drills (drill shell) but they learn the drill mechanism and apply it to their own learning.

SYSTEM DESIGN

Overview

A shell in this paper means the system with built-in drill control functions or algorithms, with an interface for a user to replace the item data. By only registering items, users can make the drill based on the built-in algorithms. Thus, even a user who has no idea of drill or instructional design can make an effective drill. Figure 1 shows the system structure. This system consists of four functions to make and learn the drill and includes three kinds of algorithms.

When users begin using this system, they have to create their account and login in to this system.

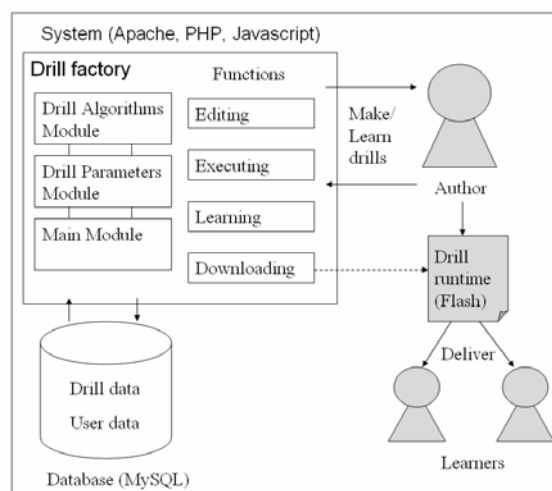


Figure 1. System structure

Drill Algorithms

All algorithms included in this system are for the learning of verbal information. Three kinds are implemented at this moment: (1) Flashcard queuing^[4] is a simply algorithm that an answered item be moved to the last. (2) Variable item interval drill^[4] is an algorithm that a missed item appears again after some interval (not last). (3) Progressive state drill^[5] is a complicated algorithm that items has a progressive sequence passing from one presentation state to another: pre-test, rehearsal, drill and review.

Editing Function

Editing function allows users to make a new drill and edit existing drills, including addition and deletion of items. It is designed to specify the minimum parameters of items. Many parameters are set by default and hidden, so users can see and change them if needed. Editing function has two parts: making a drill and editing questions.

In the part of making a drill, users have to input the title of the drill at first, and select the one of two types of questions: "common question" or "separated question" type because the editing ways are different (Figure 2). Common question type means that users can set the common question word and don't have to set to choices so that choices consist of answers of other items. Separated question type means that users have to make both the question word and all of choices for each question. In addition, users can set the explanation of drill and the cover page as an option.

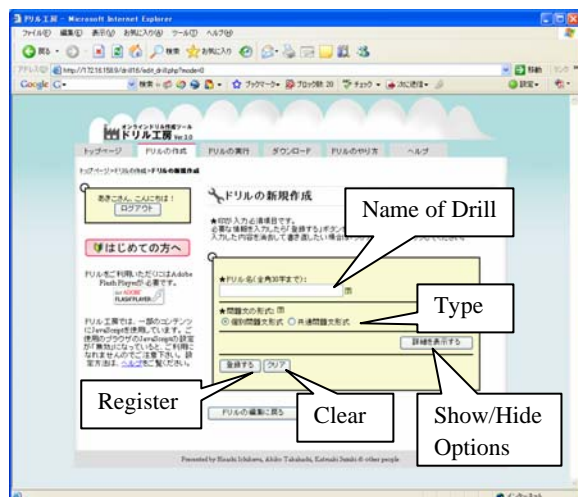


Figure 2. Making a new drill

In the part of editing question, users input pairs of a question and an answer at once in groups of ten questions, if the type is common question (Figure 3). If the type is separated question, users have to input the question word, choices, and any explanation (Figure 4) for each item. The upper limit of choices is

six. The available format of items is text, graphic or sound. The system allows users to input any explanation for each question.

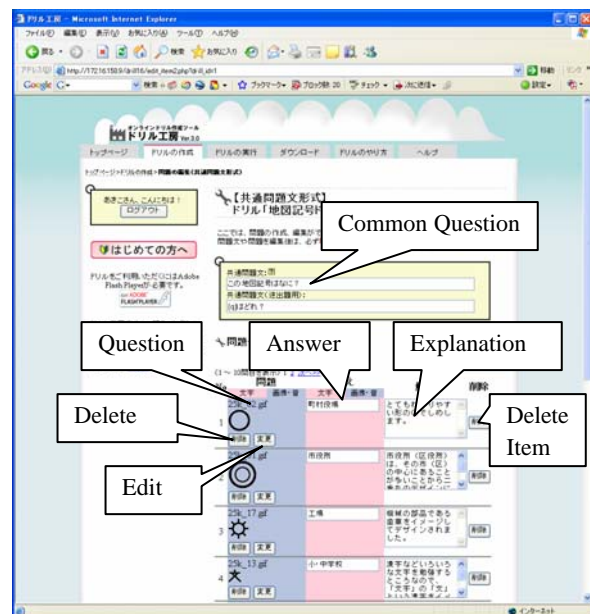


Figure 3. Making items in common question type

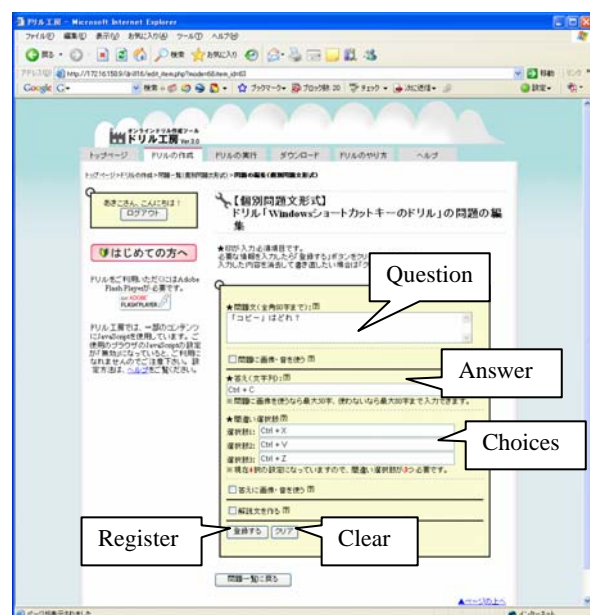


Figure 4. Making an item in separated question type

Executing Function

Executing function runs the drill made by users. This function has two kinds of modes: normal and skeleton (the skeleton mode will be described in details at the learning function). The drill shows question, users answer it, and then shows right/wrong with correct answer feedback (and explanation if any). Figure 5 shows the screen of executing drill on the normal mode.

Users can set an algorithm and parameters before the drill begins (Figure 6). Parameters are to set the

criteria for pass (the times of answers correctly to the same item), select the type of answers included selecting a choice and typing an answer, and set the number of choices.

There are some proper parameters of a particular algorithm such as the interval to show the failed item again for variable item interval drill. Appropriate parameters are only shown by each algorithm selected. Users are able to set the item direction as a parameter of the common question type. For example the drill shows the cat in English as a question and the cat in Spanish as an answer. If the direction is changed, the cat in Spanish becomes a question and the cat in English becomes an answer.

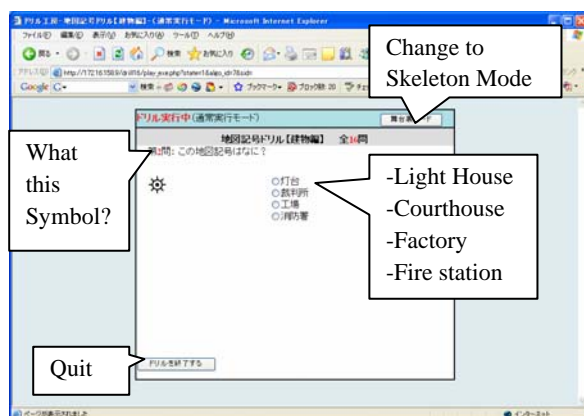


Figure 5. Executing a drill

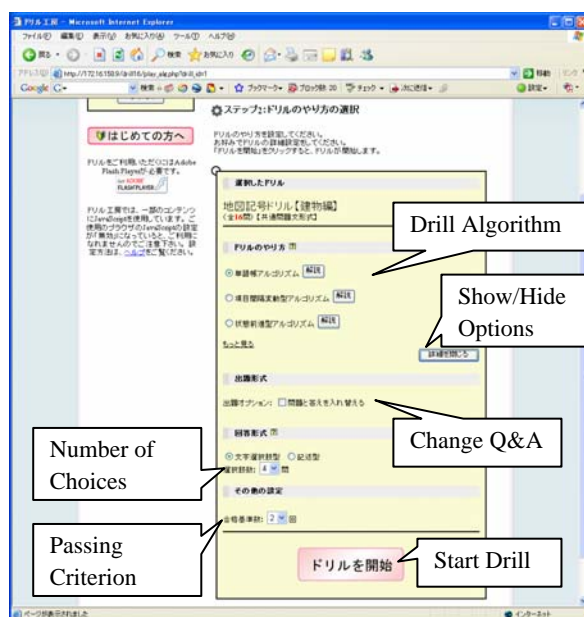


Figure 6. Parameter setting for executing drill

Downloading Function

Downloading function allows users to bring the drill to their local environment and they can use it for their e-learning with or without a network connection. Users select one algorithm and parameters the same as executing before downloading. Users set

parameters newly or select the parameter setting from records of executed drill in the past (Figure 7). The downloaded drill runs by set algorithm and parameters. The downloaded drills include a runtime program file, a setting file, and item files.



Figure 7. Downloading

Learning Function

Learning function provides an explanation of drill algorithms and shows internal process of the drill, such as the list of order and state of items, by having the drill run on the skeleton mode. The status always changes during executing a drill. Whenever users answer the item, the system updates them.

Figure 8 shows the screen of the skeleton mode. The state of items is shown in the matrix on the bottom of a screen. The rows of the matrix are the order of items and the columns are item's state. The drill parameters are shown at the left above on the screen. Users are always able to change the parameters. If changed the system, updates the state of items at once. The control logs of the drill are displayed in the bottom right corner, there are buttons for back or forward drill process and users can review their own history.

The explanation shows each flowchart of the built-in algorithms and supports users to select an appropriate algorithm for their situation (Figure 9).

IMPLEMENTATION

This system was developed by Apache, PHP, Javascript, MySQL and Macromedia Flash (Figure 1). Flash is used as a runtime for downloading. Users can use this system through the Web.

Four functions stated above have implemented in this system. The system, for the meantime, runs only Microsoft Internet Explorer. It is going to be run on the other browsers in future.

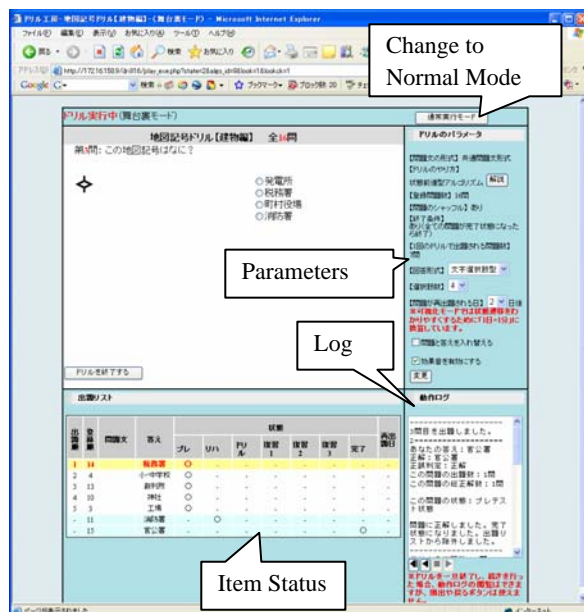


Figure 8. Executing drill on skeleton mode

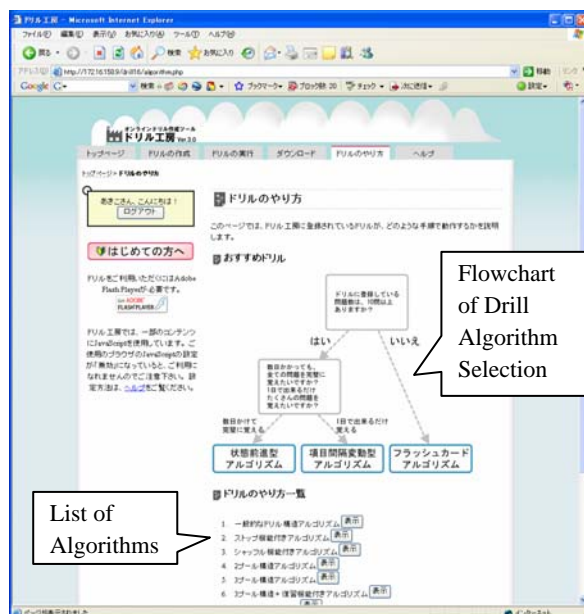


Figure 9. Explanation of drill algorithm

FORMATIVE EVALUATION

The formative evaluation of this system was done from the view point of the usability. Participants are three students in the Department of Software of university (one of them was a graduate student). In this evaluation, they used all functions through making three kinds of drills using different algorithms, and then answered questionnaire. Two of drills were created using the common question type (text only and text/image). The other was the separated question

type. Participants made all drills, executed them, read the explanation of algorithms and downloaded them. As the result of this evaluation, all of the participants could make all drills and answered in the questionnaire that they could make the drill easily (5 by two participants and 4 by one with 5-point scale, the number five is the best).

On the other hand, some problems were clear. They didn't know which type was selected well for drills of the presented task because the explanation of both common and separated question types was not enough. They represented that the explanation of the algorithms and functions was also not enough and technical terms were difficult, so the selection of an appropriate drill algorithm was complicated. In addition, despite of the check of the system before this evaluation, some bugs were identified.

Main improvements from the results of evaluation as follows:

- The explanation for the facilitation of selecting common and separated question types was added.
- The appropriate drills for user's situation were recommended using the wizard.
- The technical terms about the drill were replaced by easy words.
- Some bugs were removed.

CONCLUSIONS

In this study, we developed an integrated drill shell called "Drill-Factory" to make, use and learn about the drill by users. From the result of evaluation, it was found that this system allowed users to make the drill easily and some problems were fixed.

We are going to apply this system in our e-learning courses. Furthermore, we will shortly open this system to the public on the Web.

REFERENCES

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