Improvement of a Learning-Task Analysis Diagram Module for Moodle to Support Self-directed Learning by Enhancing Advising Feature to Learners

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Abstract: In our past study, we have developed a Moodle plug-in enabling Learning-Task Analysis Diagrams Interface. We have developed two types of User Interfaces (UI), one is for learners and the other is for teachers. The UI for learners displays Learning-Task Analysis Diagrams of the topics (learning items) in a Moodle course. Each topic is colored with a color corresponding to the evaluation of the learning results. When learner clicks one topic, contents of the topic are displayed. The developed Moodle plug-in promotes self-directed learning by visually providing the learner progress information in the hierarchical structure. In this study, we added to advising feature on learner's UI. Advising feature is system-controlled, and displays the next selection item. The learner may accept advice or may disregard.

Introduction

Recently, e-Learning has been increasingly employed in schools and corporate training. In general, the platform that is called Learning Management System (LMS) is used for the management of teaching and learning when the scale is large.

In many cases, e-Learning is designed for self-learning. For successful achievement of self-learning, learners need to have self-directed learning skills like self-selection of learning contents and learning method and self-assessment (Suzuki 2006). From a view point of supporting the self-directed learning, we developed an LMS based on Learning-Task Analysis Diagrams (Takahashi et al. 2007).

Learning-task analysis (Gagne et al. 2004) is a method of clarifying elements necessary to reach a given learning goal and the relation between the elements. A Learning-Task Analysis Diagram is a graphical representation of the analysis result. The method of learning-task analysis is different according to the type of the learning-task. In this paper, the type of the learning-task is targeted at the category of intellectual skills, and the diagram is drawn through hierarchy analysis. Fig. 1 is an example of hierarchy diagram.

The feature of the system is that the learning content designer analyzes learning-tasks and clarifies the hierarchical structure to let learners freely decides which learning item to start or make their own plan to in what order to learn. It was implemented as Learning-Task Analysis Diagram Interface. Although the system was fully functional in navigating learners with the Interface, it was not equipped with common features of LMS such as file uploading for assignment submission, etc.

Then we developed a plug-in (an additional subsystem) for Moodle that enables Learning-Task Analysis Diagram Block (Takahashi et al. 2009) (Fig. 2). And we developed authoring tool for creating Learning-Task Analysis Diagram. Moodle is one of the most popular open source LMS's. The intention of this development is to enhance Moodle to support navigating interface for self-directed learning with full availability of Moodle's standard useful features.

In this study, we improved a Learning-Task Analysis Diagram Block. We added a function of system driven advice to this Block.

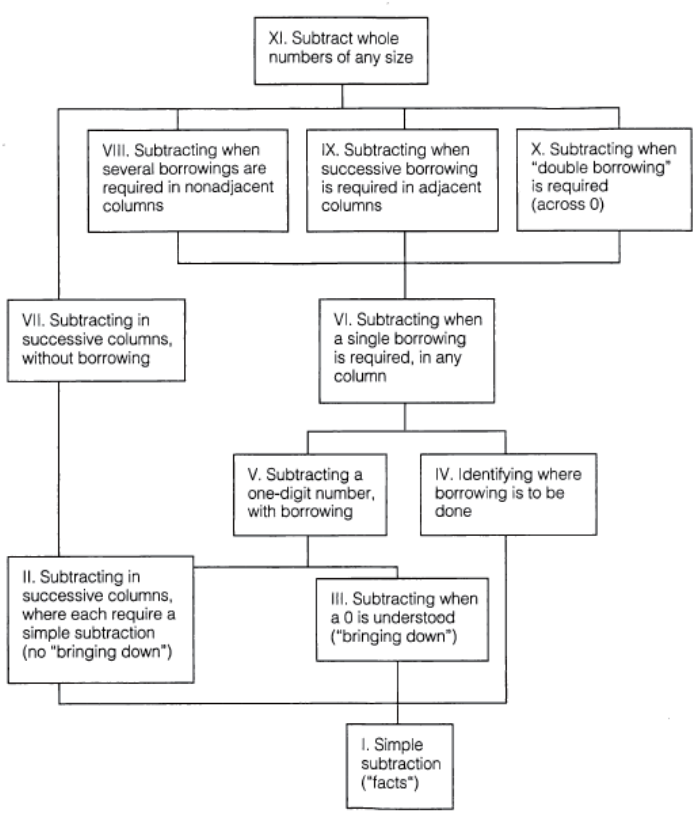

Fig. 1: Example of a Learning Hierarchy for Subtracting Whole Numbers (Gagne et al. 2004, Fig. 8-4)

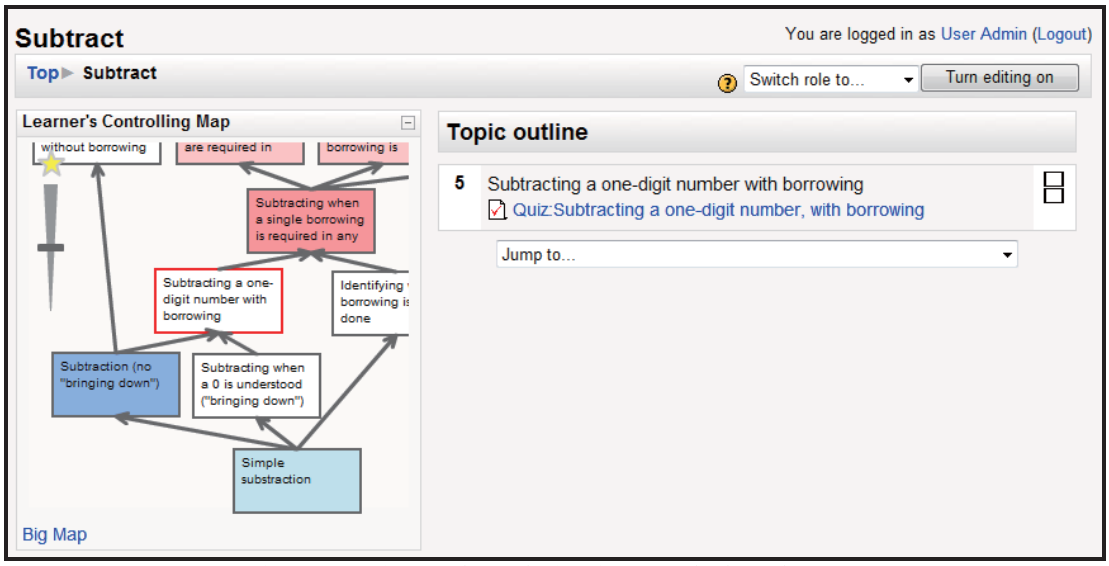

Fig. 2: Learning-Task Analysis Diagram Block for learners

Research of a performance driven remediation model

Merrill(1980) proposed some models of an adaptive system. And he refers to a performance driven remediation model (fig. 3) as one of the adaptive systems.

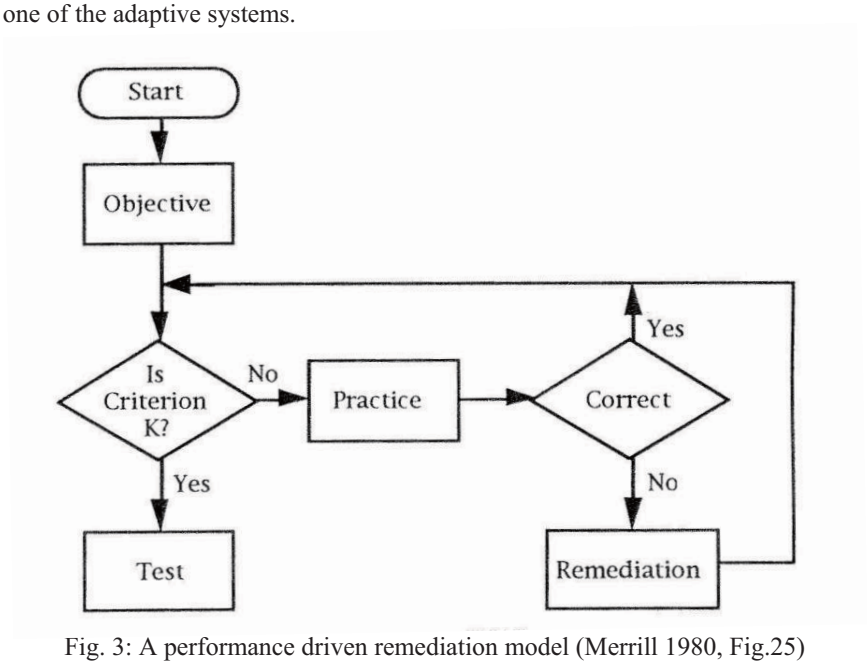

Fig. 3: A performance driven remediation model (Merrill 1980, Fig.25)

The model operates as follows (Merrill 1994): a criterion of k or k-in-a-row correct practice items is established. The learner is presented an objective, including a sample test item. The learner is next presented a practice item. If the learner responds correctly to the practice item, learner is presented another practice item until learner has met the criterion. If the response is incorrect, learner is presented some form of remediation and then presented another practice item until the criterion is met.

Example of Merrill (1994) based on Component Display Theory is as follows: first error, branch to practice-feedback-help display; second error, branch to example; third error, branch to example with example help; fourth error, branch to generality; fifth error, branch to generality-with-help. This branching structure would be reset after every correct response.

The model could be either system-controlled or learner-controlled. Merrill says, learner-controlled model is more practical. Because if every learner requires a unique combination of displays in order to optimize learner acquisition of a given lesson, then for system-controlled models the development costs begin to become unreasonable.

Therefore, it is practical that the system should be basically learner-controlled though it sometimes interrupts learners with non-compulsory advice.

Improvement

Design

In this study, improvement of advising feature was based on Merrill's model as follows;

1) Learner's UI had already been implemented with the advising feature. When a learner clicks the advice button, the system presents the learning item that should be selected based on Learning-Task Analysis Diagram. In this study,

the system judges learner's situation to present advice.

2) Performance data of quizzes in each learning item is monitored.

3) Merrill's advising feature was based on Component Display Theory. But in this study Learning-Task Analysis Diagram was used to show the appropriate next learning item.

> **advise 1 :** When the learner didn't pass 2 times on the quiz, the learner is advised to select prerequisite at next time. Example of Fig.1; when the learner didn't pass at 2 times a quiz of V, if selected one more, the system advise to select to II and III.
> **advise 2 :** When the learner didn't pass one item of quiz and prerequisite item too, if selected one more, the learner is advised to select prerequisite(and including more prerequisite) at next time. Example of Fig.1; when the learner didn't pass a quiz of VI and V, if selected VI one more, the system advise to select to V. If the learner didn't pass III, II and I, the system advise to select these items too.

4) The criterion of advice can be changed by the learner. The learner changes whether to display advice failing times how many from 1-3. But advice cannot be non-displayed.

5) The system doesn't control the selection sequence. The system only displays advice, and the learner has control of selection. When the learner accesses for the first time, the system displays the message "You (Learner) can select based on advice by the system, or you can disregard the advice. You can try to select upper level items ".

Development environment
The UI has been developed using Adobe Flash8, JavaScript, HTML, CSS, and PHP. The main feature was realized by Adobe Flash8 and ActionScript2.0. Advising message is described a file by XML. The teacher can make changes this file in consideration of the age etc. of the learner.

A performance data of quiz is acquired from Moodle's database. Additional new table is created for storing the criterion of advice. This table is constructed with fields as follows; User ID, Course ID, Criterion of Advice 1(default number is 2), and Criterion of Advice 2(default number is 1).

Conclusion

In this study, we added advising feature to learner's UI. Advising feature is system-controlled, and displays the next candidate item. The learner may accept or disregard the advice. In the future study, it is necessary to evaluate the validity and effect of the advice feature.

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