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Note-Rebuilding Based on Lecture Structure and Application in a Learning Support System

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Abstract: In the presentation-type lectures which is performed using presentation software, learners are provided well-structured slides which are useful to understand the structure of the lecture. They, however, don't need to construct their note because of the given slides. In this paper, we propose a task called "note-rebuilding" which is based on a kit-build method. We also report a learning support system with note-rebuilding and its experimental evaluation.

Keywords: Formative Assessment, Reflective Learning, Presentation Software

1. Introduction

Lectures in recent years have increasingly incorporated presentation software. Learners don't need to consider deeply information structure in the lectures because well lectures' slides structured well by teachers and they are not required to note-taking[1,2]. Especially, it is effective to reflect and rearrange the note. The reflection is called note-reflection[3,4]. In the presentation-type lectures, it is therefore necessary to propose tasks that confirm learners' understanding as note-reflection. Here we propose a "note-rebuilding" method expanding note-reflection by adapting a kit-build method[5]. In addition, we report our developed learning support system with note-rebuilding and its experimental evaluation.

2. Design of Learning Support System with Note-Rebuilding

a. Note-Rebuilding Method

In order to facilitate effective learning, we need to design adequate learning activity and individual diagnosis. Kit-build method is useful to control learners' activities and learning contents and to diagnose learners' answers. In kit-build method, teachers divide prepared learning materials into parts, which learners reconstruct. Because all learners and teachers use same material, their answers can be compared correct answer and other learners. Here we propose a note-rebuilding method as follows. First, the teacher uses presentation software to create structured slides as he/she always does for his/her class. Second, the slide is divided into several parts. Third, learners are require to reconstruct the original slide based on the parts. This method promotes learner understanding of the lecture structure.

When confirming understanding of the lecture structure, it is inappropriate to make learners summarize all the data presented; understanding the information and its structure is sufficient. We refer to structures in lecture data as "structure notes." In our note-rebuilding method, learners construct structure notes, examples of which are shown in Figure 1. Structure notes include important informational elements and the important informational structures. In the proposed note-rebuilding method, pieces of information (mainly words and phrases) included in a structure note are called elements, and the informational framework of the structure without elements is called a skeleton. The two together are called parts. A skeleton and an element are given to a learner, who assembles them appropriately, thus promoting understanding of the lecture. Figure 2 shows an example of structure note parts with a layered structure for the skeleton and its elements.

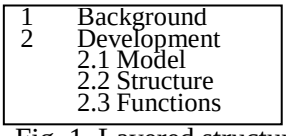

Fig. 1. Layered structure form

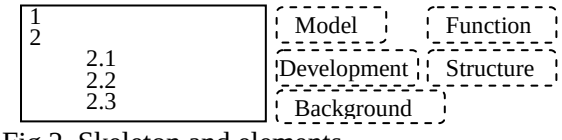

Fig 2. Skeleton and elements

b. *Learning Support System with Note-Rebuilding*

c. *Structured note data*

Our system manages the data of structured note as JSON format. First, teachers construct slides as he/she always does for his/her class using presentation software. And then, our system convert the slide to JSON format file which is used to note-rebuilding interface and diagnosis and comparison functions.

d. *Note-Rebuilding Interface*

Learners use this interface to rebuild the deconstructed note. This interface shows element cards at random by loading element information from structure note data. Reconstructed notes are sent to the server by pressing the "Send" button. Figure 3 shows an example layered structure in the interface of the actually developed system.

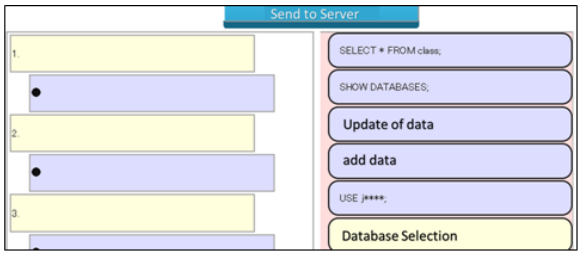

Fig. 3. A layered structure in the developed interface

e. *Diagnosis and Comparison Function*

Learners' answers are sent to and collected at a server. Our system diagnose the answer and specify where is incorrect. Furthermore, the result of having superimposed two or more learners' notes are accumulated and displayed. Learners can then reflect on their own answers by comparison with other answers and the correct answer. In addition, teachers can reflect on their lecture to improve teaching. Moreover, teachers can immediately respond to inadequate learner understanding immediately following a lecture by providing supplementary explanation. Figure 4 shows an example of collected learners' answers in the layered structure.

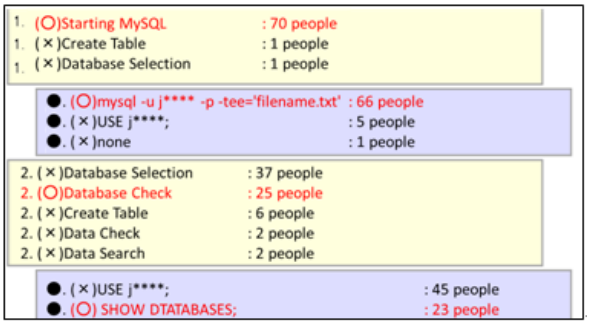

Fig. 4. Collected answers

3. Use in Practice and Evaluation

We report the results of experimental use of the proposed system in lectures for a university programming course. The lectures concerned following two contents: how to use MySQL and how to control MySQL with PHP, which was content for review. Participants were 70 university undergraduates majoring in engineering. First, the teacher taught a lesson using presentation software for reviews for 6 min. This corresponds to a usual class. Second, learners took pre-test for 6 min. Thirdly, they learned how to use our system for 6 min. The teacher again taught with comparison function for 6 min. The learners took post-test for 6 min. The items on both pre- and post-tests were the same: subjects freely described the process of manipulating MySQL alone and manipulating MySQL using PHP. Both responses required describing five steps. Adequate description of the procedure was scored as a right answer.

First, we report the results of using our system. Figure 4 in 2.2.2 shows the results of the practice. In this lecture, the teacher explained that learners should run MySQL, check databases, and then select a database. More than half the subjects misunderstood, however, thinking they should select a database first, and then check it. The teacher emphasized this point using the comparison function. Next, we report the results of pre- and post-tests. In these tests, learners freely described the five steps for running MySQL to control a database. Incorrect answers were missing steps, or steps given in the wrong order. Items given in the wrong order were corrected. For example, if a learner described the order as step 1, step 3, step 2, we marked this as step 1/step 1, step 3/step 2, and step 3/step 2. When a step was missing, the place for the step was left blank, for example: step 1/step 1, [ ]/step 2, and step 3/step 3. The results are shown as Tables 1, 2, 3, and 4.

Table 1 shows that a majority of subjects (53) described Step 1 (starting MySQL) in the correct order in the pre-test. However, only 15 subjects correctly described Step 2 (database check), and 9 subjects mistook Step 3 (database selection)for Step 2. This was also checked with the system's comparison function as described in Section 2.2. Table 2 shows that the number of subjects who could describe all the steps appropriately increased. Table 3 shows that PHP was a weak point for many learners, and lectures alone were insufficient for understanding. However, table 4 shows that the number of subjects who adequately understood the steps increased when our system followed the lecture. Subjects were asked whether they could use our system effectively, and responded using a four-point Likert scale.

Table 1. Results of pre-test about MySQL

Subject / Correct	Step 1	Step 2	Step 3	Step 4	Step 5
Step 1	53	0	0	0	0
Step 2	0	15	9	0	0
Step 3	0	7	20	0	0
Step 4	0	0	0	12	0
Step 5	0	0	0	0	19

Table 2. Results of post-test about MySQL

Subject / Correct	Step 1	Step 2	Step 3	Step 4	Step 5
Step 1	62	0	0	0	0
Step 2	0	42	9	0	0
Step 3	0	8	45	0	0
Step 4	0	0	0	43	0
Step 5	0	0	0	0	45

Table 3. Results of pre-test about PHP

Subject / Correct	Step 1	Step 2	Step 3	Step 4	Step 5
Step 1	15	0	0	0	0
Step 2	0	3	0	0	0
Step 3	0	0	3	0	0
Step 4	0	0	0	2	0
Step 5	0	0	0	0	1

Table 4. Results of post-test about PHP

Subject / Correct	Step 1	Step 2	Step 3	Step 4	Step 5
Step 1	54	0	0	0	0
Step 2	0	40	0	0	1
Step 3	0	0	29	3	0
Step 4	0	0	2	12	2
Step 5	0	0	1	1	28

4. Conclusion

We focused on lectures that use presentation software. In such lectures, learners are not required to conduct tasks for understanding the lesson structure. We therefore proposed a note-rebuilding method and developed a learning support system with the method. We focus on slides that many teacher make usually in lectures using presentation software. In note-rebuilding method, the slide is divided into several parts. Learners are require to reconstruct the original slide based on the parts. Actual implementation revealed that the method promotes the learner understanding of lecture structure.

In our system, learners' note are collected to diagnose and to compare. In our future work, we plan to add analysis function which clusters learners' answer and reveal common errors. The function enable teachers to improve lectures' information structure based on structure of learners' errors.

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