

Development of a Learning-Task Analysis Diagram UI for Moodle to Support Self-directed Selection of Learning Contents

Akiko Takahashi

Graduate School of Instructional Systems, Kumamoto University, Japan
atakahashi@st.gsis.kumamoto-u.ac.jp

Toshihiro Kita

Graduate School of Instructional Systems, Kumamoto University, Japan
kita@ield.kumamoto-u.ac.jp

Hisashi Ichikawa

Faculty of Software and Information Science, Iwate Prefectural University, Japan
ichikawa@iwate-pu.ac.jp

Hiroshi Nakano

Graduate School of Instructional Systems, Kumamoto University, Japan
nakano@cc.kumamoto-u.ac.jp

Katsuaki Suzuki

Graduate School of Instructional Systems, Kumamoto University, Japan
ksuzuki@kumamoto-u.ac.jp

Abstract: In our past study, we developed an e-learning system based on Learning-Task Analysis Diagrams. In this study, we have developed a Moodle plug-in enabling Learning-Task Analysis Diagrams Interface that is a part of the previous system. 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 you click 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. The UI for teachers is a GUI to create Learning-Task Analysis Diagrams. The developed system has been evaluated from the viewpoint of both learners and teachers. The evaluation results are sufficiently high.

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).

The feature of the system is that the learning content designer analyzes learning-tasks and clarifies the hierarchical structure to let learners freely decide 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 (Fig. 1). 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.

Overview of the developed UI

Setting up the UI

The developed UI is packaged as a course format of Moodle. To use the UI, login to Moodle as a teacher or an administrator, and go to 'Edit course settings' page (Fig. 2). When you choose "Learning-task analysis format" among a list of format choice, the UI is displayed on the course top page.

The main features of the the UI for learners and the UI for teachers are as follows.

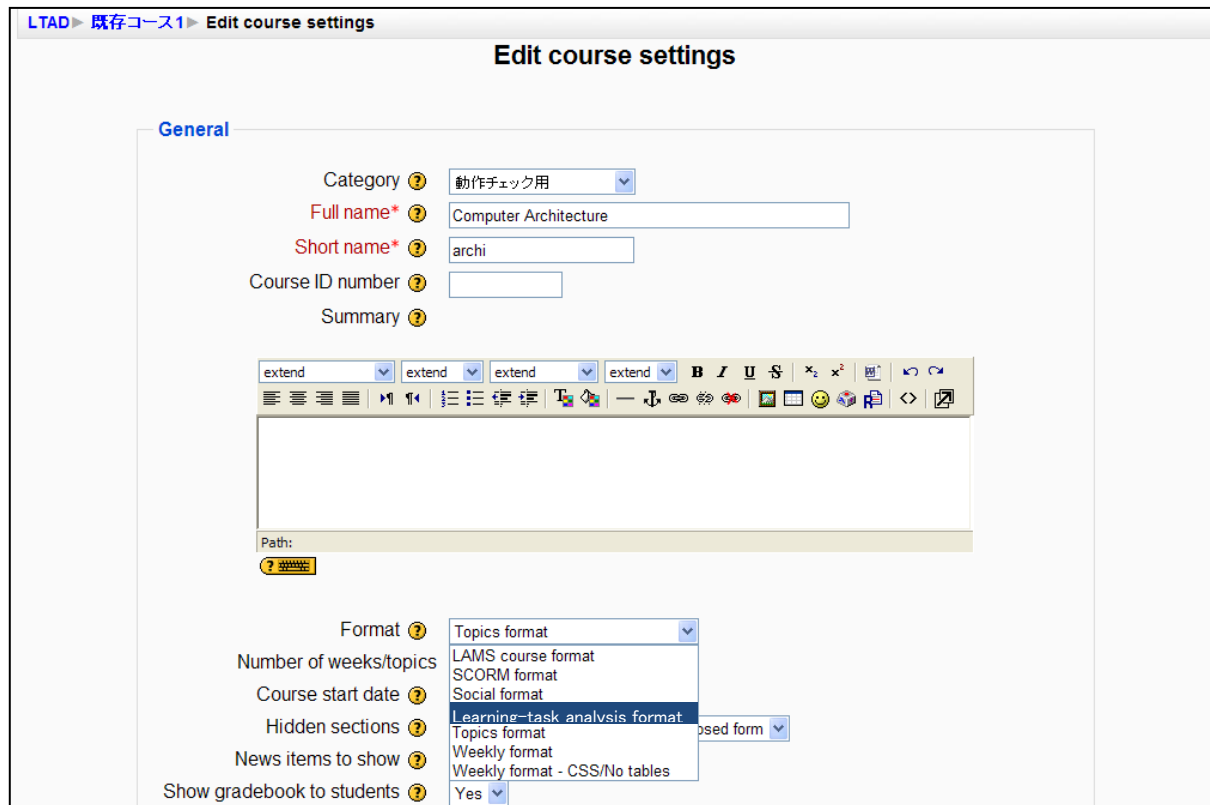


Fig. 2: Edit course settings page

(1) The UI for learners

The main features of the developed UI have been mostly inherited from the system developed in our past research.

Navigation

In this study we focus on the navigation of some topics contained in one course of Moodle. The topic is a unit consisted of learning contents of the web pages, the forums, and quizzes, etc. Usually topics queue up in the order decided by the content designer (Fig. 3).

This UI shows the relation structure between the topics in a course (Fig. 4). The learner will be able to understand the structure quickly by seeing the diagram, and to select the topic. When the learner clicks on a topic in the diagram, the learning contents included in the topic are displayed under the diagram. All topics can be selected anytime so that learners can autonomously decide where to start and which to select.

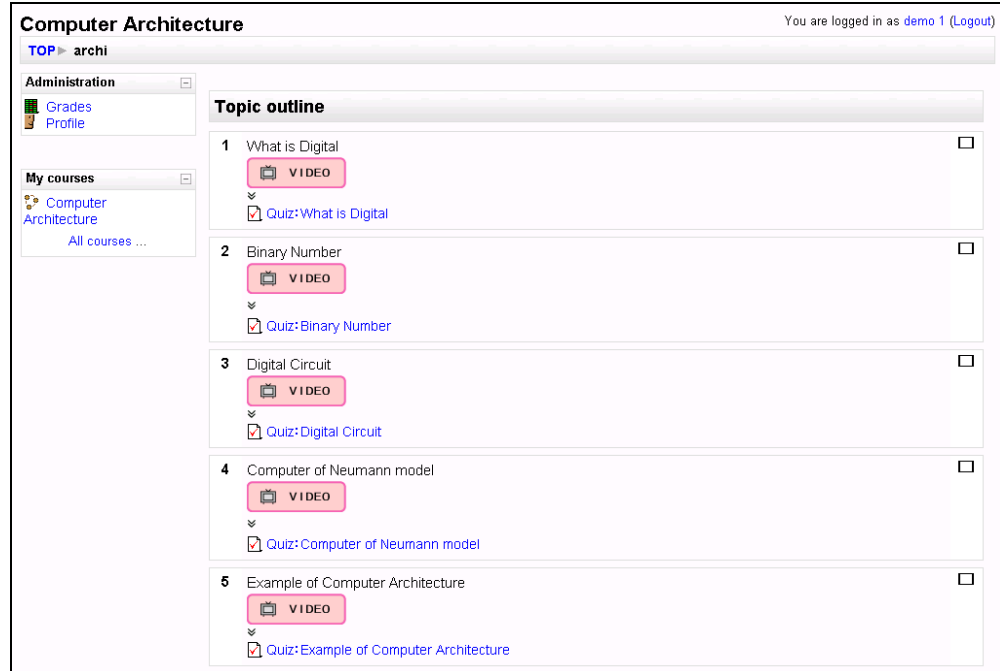


Fig. 3: Moodle course top page (standard)

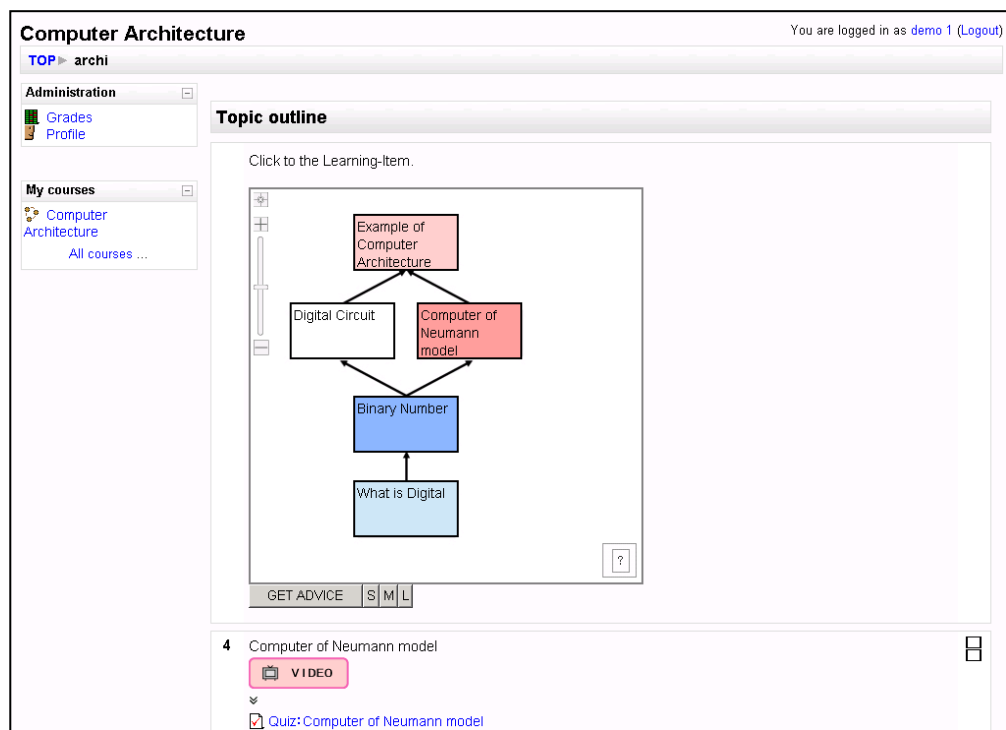


Fig. 4: The developed UI on Moodle

State indication

The topic boxes are colored to indicate the state of learning progress. Table 1 is the summary about the color and the state. The purpose is promoting learner's recognition of their learning progress. When the learner correctly answers all the questions in the topic quiz, this plug-in judges the topic as "Passed A".

Table 1: The color of topic boxes and the states indicated

Color	State
White	Never accessed
Dark Red	Not passed A (accessed but the quiz not passed)
Light Red	Not passed B (automatically judged as not passed because a "Not passed A" topic is prerequisite for this topic)
Dark Blue	Passed A (the quiz passed)
Light Blue	Passed B (automatically judged as passed because this topic is prerequisite for a "Passed A" topic)

Usability

For better usability, the following functions have been added.

- The diagram moves when you drag it.
- The diagram zooms-in and zooms-out by Slider Bar or Mouse Wheel.
- The outline and the quiz result of a topic appear when the mouse pointer is put over the topic box.

(2) The UI for teacher

Learning-Task Analysis Diagrams differ according to the types of learning tasks (Gagne et al. 2004). In this paper we focus on the intellectual skills. Therefore, we have developed the UI for teachers on the assumption that a teacher makes learning-hierarchy analysis diagrams. The developed UI is graphical so that the teacher can complete a diagram while the teacher makes trials and errors.

Usability

This UI gets a part of the summary information of each topic and lists topics in the left of the screen. A teacher can move a topic by drag-and-drop in the editing area. They put a difficult topic on top area, and put a fundamental topic on under area. And they pull a line in under topic from top topic (Fig. 5).

Guide for creating Learning-Task Analysis Diagrams

Even if the UI is graphical, a teacher cannot make an appropriate diagram if he/she does not understand the meaning of the Learning-Task Analysis. Therefore, for teachers who do not know how to make Learning-Task Analysis, this UI has a guiding feature. When guiding feature is ON, the UI displays automatically a message. For example, "At a lower position, please place a more fundamental topic needed to understand the topic you just placed". We premised that e-learning contents were already completed on Moodle, so the message is simple just to clarify structure between the topics, not a detailed explanation of how to make Learning-Task Analysis.

And when you click on a help-button, a page explaining the meaning of Learning-Task Analysis is displayed in another window. At the evaluation stage, we gathered opinions from teachers about the information and timing of the message.

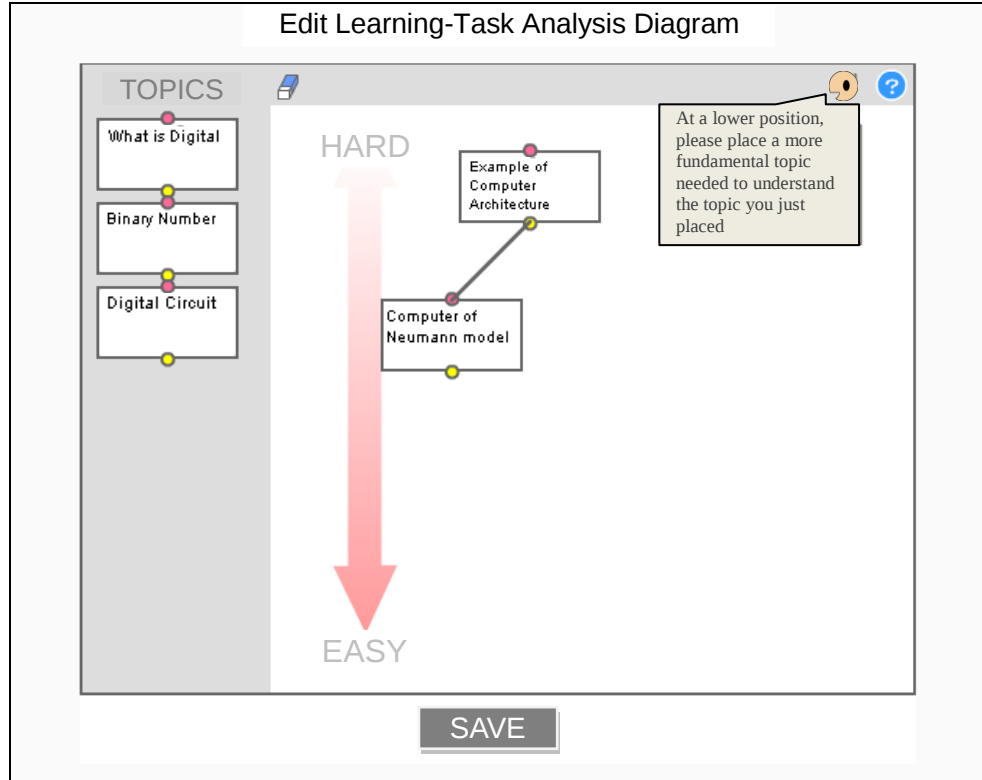


Fig. 5: Authoring Tool for Learning-Task Analysis Diagram

Implementation

Development environment

The learner's UI has been developed using JavaScript, HTML, CSS, and PHP. The main feature was realized by JavaScript. The teacher's UI has been developed using Adobe Flash8 and ActionScript2.0.

Supported version of Moodle

The supported Moodle version is 1.9. The target browser is InternetExplorer6 or the later version, and necessary plug-in is Flash Player8 or the later version.

Structure of the database

We added two points of improvement to an existing database of Moodle. To the existing table of mdl_course_sections, we added four fields. The four fields are for the position information of the quadrangle in the diagram (x coordinate, y coordinate), and information of the size of the quadrangle (width, height). And we made a new table mdl_course_sections_struct. This table maintains structure information between topics. The information is consisted of the ID numbers of higher topics and lower topics that are related to each other.

Formative evaluation

The purpose of the evaluation is to check the usability and to clarify what should be improved. We used different courses and processes for evaluating the UI for learners and the UI for teachers.

(1) Evaluation of the UI for learners

Process of evaluation

Four university students who are majoring in Software and Information Science joined the evaluation. We had them learn in the e-learning course of "The computer architecture" that they learned as a required subject when they were fresh students. They tried e-learning course with the UI for learners and normal e-learning course (without the UI). And we interviewed them with a questionnaire. The questionnaire consists of questions that ask rating points from 1 to 5 about usability and usefulness of the UI.

Result and consideration

As for the result of the questionnaire, rating of usability was on the average 4.25 about all the items, one of which is "I could move the diagram (dragging operation) smoothly". It was suggested that learners were able to operate the UI well.

About usefulness of the UI, we asked them a question, "When you study by yourself, which do you choose, a normal course or a course with Learning-Task Analysis Diagrams UI?" All the members chose "a course with Learning-Task Analysis Diagrams UI". As the reason, there were two opinions. One opinion is "It is good that I can understand my progress at a glance". The other opinion is "I can learn in the order from the fundamental learning items to the hard learning items by using the UI". It was suggested that the UI was useful to understand the learning progress and learning structure intuitively.

But there was also an opinion like "If the course top has a table of learning progress report, I think that there is no need for the UI". The learner seems to get an impression that the UI for learners will be more useful for a more complicated learning task, because the number of learning items of this sample course was only 5.

During the interview, a bug in the display was found. "Some part of a hint for operation of the UI is not displayed at all." "The display flickers.", etc. The cause of the bug is the browser dependency. The main feature of this UI has been developed using JavaScript and CSS. It is not easy to support any browser, but the cross-browser compatibility will be necessary. It is also necessary to evaluate how much self-directed learning is promoted with this user interface by a long-term testing.

(2) Evaluation of the UI for teachers

Process of evaluation

Four people in total joined. Two of them are university students (who have experience of Moodle course creation) and two are teachers (without experience of Moodle). Firstly they operated the UI for learners to understand the feature. Next, they created a Learning-Task Analysis Diagram with the UI for teachers based on given pre-analyzed data. Finally we interviewed them with a questionnaire (1 to 5 ratings) about the usability of creating a diagram. We also collected opinions by asking them "What kind of support is effective for you to make Learning-Task Analysis if you do not know how?"

Result and consideration

As for the result of evaluation, all of them were able to make a Learning-Task Analysis Diagram (on subtraction of numbers) with the UI. The average time needed to complete the diagram was about 10 minutes. Fig. 6 shows an example of diagrams drawn in the evaluation.

Low-score items in the questionnaire were the following: Item A "I was able to connect learning items with a line" (the average score is 3.0) and Item B "The contents of a help message displayed in a pop-up window were useful" (the average score is 3.5).

As a reason for the low score of Item A, we got a comment "Drawing a line needs very sensitive operation. Some grid-based pining feature would be much appreciated." It is necessary to examine how to improve the operability. Another comment says "I don't have confidence whether I was able to make an appropriate Learning-Task Analysis Diagram if I apply this UI to my own course." This is not an operation problem but a problem of difficulty in analyzing the learning-task structure. It is a common problem that should be solved to make this kind of UI to be

widely used. Like another comment insists, there should be some way to share Learning-Task Analysis Diagrams that other teachers have created. It can be a solution for the problem just mentioned.

About Item B, the help message was certainly useless because it was just a simple description about Learning-Task Analysis.

In response to the question of “What support do you think you need to create a Learning-Task Analysis Diagram?”, we got the following comments: “Clarification of the meaning of arrows”, “Step-by-step explanation of actual procedures in creating a diagram”, “A movie that shows how to draw a line”, “A concrete example of Learning-Task Analysis Diagram”. Improvement of the authoring tool should be done taking these comments into consideration.

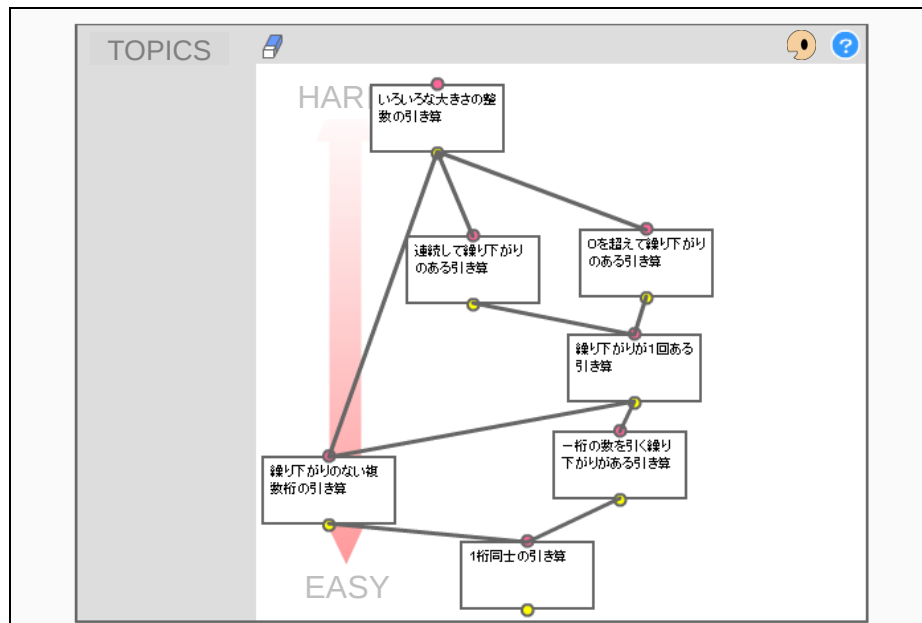


Fig. 6: Example of Learning-Task Analysis Diagram

Conclusion

In this study, we have developed a Moodle plug-in enabling Learning-Task Analysis Diagrams Interface that is a part of the previous system we developed. The developed Moodle plug-in promotes self-directed learning by visually providing the learner progress information in the hierarchical structure. The UI for teachers is a GUI to make a Learning-Task Analysis Diagrams. The developed system has been evaluated from the viewpoint of both learners and teachers. The evaluation results are sufficiently high. It is necessary to evaluate how much self-directed learning is promoted with this user interface by a long-term testing. In addition, we have also a plan to multilingualize the interface for its public distribution.

References

- Gagne, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. (2004). *Principles of Instructional Design*. (5th Edition), Wadsworth Publishing
- Suzuki, K. (2006). *Chapter 7 Method of structured and Learner Control that supports self-directed Learning*. Human information science and e-Learning, 104-117 (in Japanese)
- Takahashi, A., Ichikawa, H., Abe, A. & Suzuki, K. (2007). *Development of a Self-directed e-Learning System based on Task Analysis Diagrams*: Short Letter in Journal of the Japan Society for Educational Technology, Vol. 31[suppl] , 25-29 (in Japanese)