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Author(s)	猪俣, 敦夫
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Description	Supervisor:落水 浩一郎, 情報科学研究科, 修士

Organizing Electronic Teaching Materials for *On-Demand Learning*

Inomata Atsuo

School of Information Science,
Japan Advanced Institute of Science and Technology

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1 Background and Purpose

It is important for the engineers engaged in the production of high technology to augment knowledge in daily work, because the results of several fundamental researches are useful for developing new products. Such kinds of useful knowledge can be accumulated in higher education system of a research organizations of the top technology. If the engineers can use the system provide over a computer network, efficiency of their task will be improved. However the engineers can not have enough time for acquiring the knowledge in daily work. If they can use the distance learning study system, they can learn in a favorite place, at any time. Many distance learning systems already exist. However they have been not necessarily designed from a viewpoints of learner, but according to a teacher's position. So we assume that it will be difficult for learners to acquire the knowledge according to their demands.

In this paper, we propose a learning style featured by learner-centered, condition-oriented, collaboration-based concept. We call such a learning style *On-Demand Learning*. We examine requirements to carry out On-Demand Learning and realize a prototype system. And we examine usefulness of the requirements to carry out On-Demand Learning from the results of the evaluation for our proposed system.

2 What is On-Demand Learning?

We define three principles for the distance learning as follows;

- Learner-Centered : Learning is an individual knowledge acquisition activities. Teaching materials should be given by learner-centered organization but not teacher-centered.
- Condition-Oriented : It also should be accessed from a favorite place at a learner's favorite time according to each situation.
- Collaboration-Based : Knowledge acquisition is performed over a computer network. It is useful for someone to collaborate the others which are interested in the same topic.

We assume that the following conditions should be satisfied in order to design the learning system that is realized based on the above principles. Note that we call such a learning system *On-Demand Learning* system.

- A learner can immediately acquire the knowledge according to his/her demands.
- The learning style can be provided for a learner without the time limit for learning or the geographical restriction.
- The knowledge is provided for a learner must always keep the newest.
- The learning targets exist in not only the study space which a learner is engaged in, but the other space where strages the learning contents which is related with the learner's demands.

3 Requirements for On-Demand Learning

In this section, we examine the functions to realize requirements for designing a system that carries out learning style of the On-Demand Learning. To realize the mechanism for acquiring the knowledge easily which "Tsumamigui learning", which only provides the teaching contents that learners want to learn, is one of the useful methods. The contents reference mechanism of a learning content retrieval function from all of the learning contents is too. Furthermore the interface mechanism which instructs the procedure at the time of learning is. To learn without a time limit for learning and geographical restrictions, connecting a teacher and a learner by the network is one of the useful methods. This method enables to keep asynchronousness between a teacher and a learner. However, multimedia data, such as the video image which should be treated by On-Demand Learning system, have the huge amount of data. We must consider the use of wide band network(ATM-LAN etc) and the special protocol(streaming technology is being used) is to treat such data. A teacher must manage the version of learning contents, because the knowledge provided for a learner may be modified. We assume that the technique of Smart Update system will help to provide the newest learning contents. In addition, if Smart Update system is used, the newest learning contents are provided for a learner only by adding the newest knowledge to the original contents. The useful knowledge will

exist in not only the knowledge stored into the system used by a learner. The links to other knowledge resources will be useful. However if the number of the links increase, it will be difficult for a learner to find useful links for their demands. So we must consider the way of component management in the On-Demand Learning system.

4 Design of Prototype System

We design a prototype system which have introduced some requirements to realize the learning style of On-Demand Learning. And we examine usefulness of the requirements. The prototype system consists of the main image viewer(the image of a teacher), the image viewer of a OHP and or a blackboard, a text-based viewer(the display of sentences spoken by a teacher) and a learner's event viewer(the contents of the display by user events).

Note that this system can be performed on a WWW browser.

- To translate the teacher's voice into the text-based documents and to display the documents.
- To retrieval the knowledge from learning contents according to a learner's demands.
- To support prerequisite conditions.
- To compose teaching senario files in learning contents.
- To link together the images.

We have adopted two graduate students in computer science course as subjects at an experiment to evaluate a prototype system. Two subject must acquire the knowledge from the same learning contents by using our designed system at the experiment. After the using the system, we have interviewed about the system. The results showed that the support of prerequisite conditions and the text-based teaching function were to some extent effective. However, there was a problem that it was very hard to catch a teacher's sound. It is thought that being considered as this cause occured when taking in and processing to the problem at the time of carrying out video photography and a computer. In spite of having used high-compressed data about the video image so that it might become about 1/10 size of original data, on an actual system, it turns out that it is not a problem so much. In the viewer of four screen always being displayed about a user interface, since it was hard to see, there was also opinion that it is better to be able to perform customize which responded to the student so that only the screen for which a student is needed could be displayed. Furthermore we have recognized that it is necessary for a learner to review a lecture.

5 Future Works

We confirmed that requirements was to some extent validity for carrying out On-Demand Learning by evaluating our proposed prototype system. However the technical problem

which became clear by system evaluation needs to be solved, the requirements of further others need to be realized on a system, and it needs to check about the validity. We improve the style of the On-Demand Learning by the following consideration.

- Research about the transmission between networks of multimedia data.
- The bidirection which is one of the validity which a network has in an On-Demand Learning system is made to realize.