Design and Construction of the Cooperation Support Agent for Face-to-face Class and E-learning

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Abstract: E-learning study mainly helps acquisitions of knowledge. However, the effect acquired from dialog on a face-to-face class is not expectable. Thus, Blended-learning which combined a face-to-face class and e-learning attracts attention. Although the blend of ideal Blended-learning should be used by learners on consideration of their capabilities and learning records, the realization is difficulty. In this paper, we proposed and built a mobile agent system which offers cooperation support with a face-to-face class and e-learning. The mobile agents operating autonomously indicate the learner's weak points and contents which should be learned from a learning plan (learning policy) given by the contents creator and a personal learning record. Therefore, the mobile agents can support the Blended-learning by creating the personal learning result data in consideration of personal capability and personal learning records.

1. Introduction

Recently, many e-learning contents are created. First, Let us focus about a lecturer who creates contents. In order that everyone can use contents easily, the contents creater should make instructional design[1] including a learning plan clear.

There are many lecturers who take charge of a face-to-face class in particular among contents creator. Therefore, there is a request that such a contents creator wants to specify the relation of contents and face-to-face class in a instructional design. Moreover, the contents creator doesn't create all contents but develops subcontents with a learning plan as parts. In this way, development performance becomes better by consolidation or reuse about parts of contents. Therefore, we should support to search a related subjects of contents automatically from a face-to-face class or contents.

Next, Let us focus about a lerner who is a contents user. E-learning study mainly helps acquisitions of knowledge. However, the effect acquired from dialog on a face-to-face class is not expectable. Thus, Blended-learning which combined a face-to-face class and e-learning attracts attention[2]. Until now, various methods are proposed in the blend method of a face-to-face class and e-learning. For example, one method is that a learner studies by e-learning before receiving a face-to-face class in order to gain the ability more than some level, and another method is that e-learning is carried out after a face-to-face class in order to confirm the achievement degree. Although the blend of ideal Blended-learning should be used by learners on consideration of their capabilities and learning records, the realization is difficulty. As the reason, a contents creator needs making a rule which can perform many study selections, in order to cater to a request of a learner flexibly. Because the treatment of the learning record in the conventional LMS (Learning Management System) is only aimed at an analysis of scores on the e-learning and learning records, it cannot be operated in the viewpoint of the optimal study.

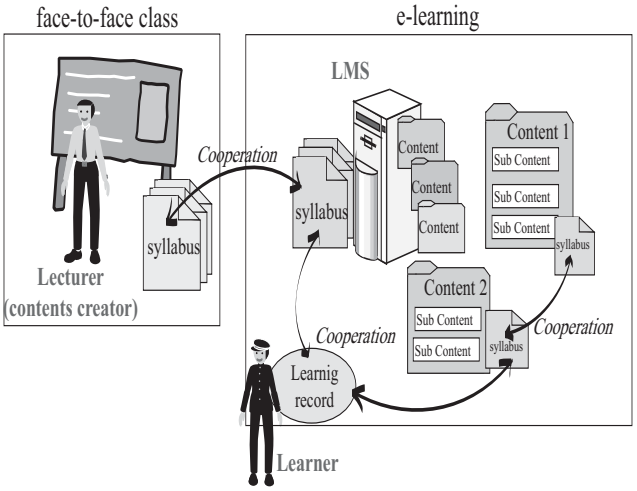

Figure 1. Concept of cooperation support for face-to-face class and e-learning.

Therefore, we should support to blend contents(subcontents) and face-to-face class in consideration of personal learning records.

In this paper, we proposed and built a mobile agent system which offers cooperation support with a face-to-face class and e-learning. The mobile agents operating autonomously indicate the learner's weak points and contents which should be learned from a learning plan (learning policy) given by the contents creator and a personal learning record. Furthermore, the mobile agent searches a related subjects of contents automatically from a face-to-face class or subcontents, and show the found subjects in a syllabus. Therefore, the mobile agents can support the Blended-learning by creating the personal learning result data in consideration of personal capability and personal learning records.

2. Concept of cooperation support

Figure.1 shows a concept of cooperation support for face-to-face class and e-learning. The data for cooperation support are two kinds of syllabus and personal learning records. We

propose the mobile agent with these data and offer the next cooperation supports.

[Cooperation(1)]

The Cooperation(1) is performed in a cooperation support which makes a relation between some contents (and subcontents) and face-to-face classes. This is automatically inputted the face-to-face class name and the contents name, by mobile agents.

[Cooperation(2)]

The Cooperation(2) is that a learner's weak points and the subjects which they should study are clarified by check on the e-learning syllabus(learning plan) and the learner's learning record. Then, a new learning plan is proposed and the support to the learner is performed.

2.1 Introduction of mobile agent

The mobile agent is a kind of distributed processing technology and is an autonomous program which processes while moving between computers. Freedia[3] is used in this research. In Freedia, each agent has a negotiation function by own plans (a policy, XML description). Thus, plans can be decided flexibly.

Agents are created in this mobile agent system. Agent's kinds are agents for every lerner, agents for every face-to-face class, and agents for every e-learning .

2.2 Necessary data for cooperation support

In order to obtain the data, the following three kinds of data are prepared.

(a) Learning plan for face-to-face class which a lecturer decided
(b) Learning plan including the capability judging standard which a lecturer(contents creator) decided
(c) Learning result that judged the learner's capability

The item (a) uses a syllabus of face-to-face class. The several keywords showing a study outline are included in a syllabus.

The item (b) uses an e-learning syllabus proposed in this paper. We adapt a syllabus form already used in a face-to-face class for item (a) the learning plan, because the learning plan by a lecture, the attainment target, and the capability judging are clarified.

The item (c) uses a learner's learning records. After a learner learns on LMS, the personal learning record is automatically created by LMS. we can obtain the data for judging the present capability from learner's learning record and the judging standard of the capability.

The following section explains an e-learning syllabus in detail.

2.3 e-learning syllabus

Figure.2 shows an e-learning syllabus.

The contents for education should attach LOM, in order to advance sharing and circulation. There are IEEE LOM[4]

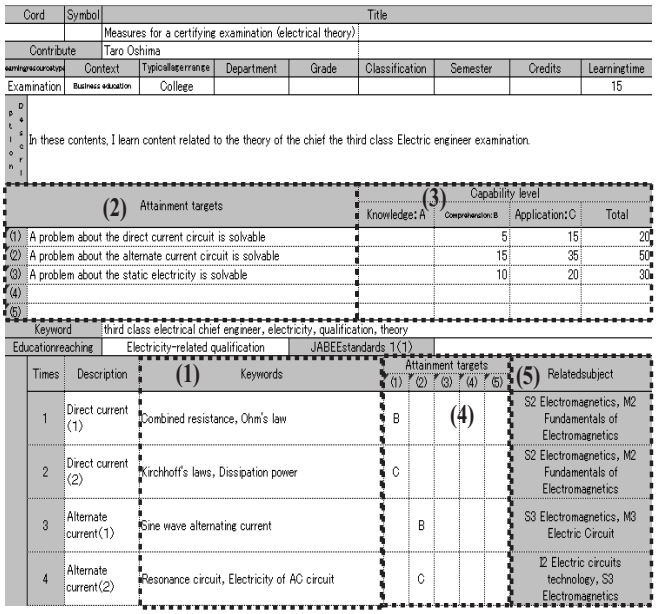

Figure 2. e-learning syllabus.

of the global standard and NIME LOM[5] of the Japanese standard based on the global standard. The item described in an e-learning syllabus was decided according to the item of NIME LOM (for example, Title, Contribute, Content, Grade, Keywords, etc.).

We set up items for cooperation support, in addition to the items of the face-to-face class syllabus, as shown in Figure.2(1),(2),(3),(4).

As shown in Figure.2(1), we set up keywords showing outline of each subcontents.

As shown in Figure.2(2), we set up a maximum of five attainment targets. Each attainment target is evaluated in three steps of the capability level, A, B, and C (see Figure.2(3),(4).

(A) Knowledgeable (low-level) : Can be memorized for term and rule.
(B) Comprehensible (medium-level) : Can be understood and explained for matter.
(C) Applicable (high-level) : Can be adapted for a new situation in known in formation.

We determined these capability levels on the basis of Congnitive domain of taxonomy[6]. The keywords of these capability levels are as follows.

The keywords of (A) are defines, describes, identifies, knows, outlines, recalls, recognizes, reproduces, and selects. The keywords of (B) are comprehends, converts, distinguishes, estimates, explains, generalizes, gives Examples, interprets, and paraphrases. The keywords of (C) are applies, changes, computes, constructs, demonstrates, discovers, modifies, produces, relates, and solves.

2.4 LOM for a syllabus

The syllabus is saved by XML description including the tag based on NIME LOM of Japanese standard specification, and is used as a cooperation support plan of the mobile agent.

Table 1. LOM base schema structure.

No.Name	Explanation
1. general	general information that describes this learning object as a whole.
2. Educational	describes the key educational or pedagogic characteristics of this learning object.
3. Technical	describes the technical requirements and characteristics of this learning object.
4. Rights	describes the intellectual property rights and conditions of use for this learning object.
5. lifecycle	describes the history and current state of this learning object and those entities that have affected this learning object during its evolution.
6. Relation	defines the relationship between this learning object and other learning objects, if any.
7. Meta-Metadata	describes this metadata record itself (rather than the learning object that this record describes).
8. Classification	describes where this learning object falls within a particular classification system.
9. Additional	describes the additional information which is not in the category of 1 to 8.

Table.1 shows the schema structure of NIME LOM.

A face-to-face syllabus is saved by one XML file format.

An elearning syllabus is divided and saved at three XML file format. The first file includes only the same item as NIME LOM. The second file includes attainment targets, capability level, and keywords of subcontents. The third file includes data that automatically inputted the face-to-face class name and the contents name, by mobile agents, as shown in Figure.1(4).

In this way, by dividing and managing files, proposed system can also have LOM for registering with NIME-grad of japanese standard at the same time.

3. Mobile agent system for cooperation support

3.1 The proposal of functions

Here, demanded functions are classified to the lecturer (contents creator) and the learner.

(F1) Functions for the lecturer (contents creator)
- *(F1-1)* Function to offer subcontents on the attainment targets which the learner selects
- *(F1-2)* Function to suggest subjects related with each contents, subcontents, and face-to-face class (Show related subjects)

(F2) Functions for the learner
- *(F2-1)* Function to judge the present capability (pass/fail attainment target) of a learner
- *(F2-2)* Function to propose the subcontents which a learner requests

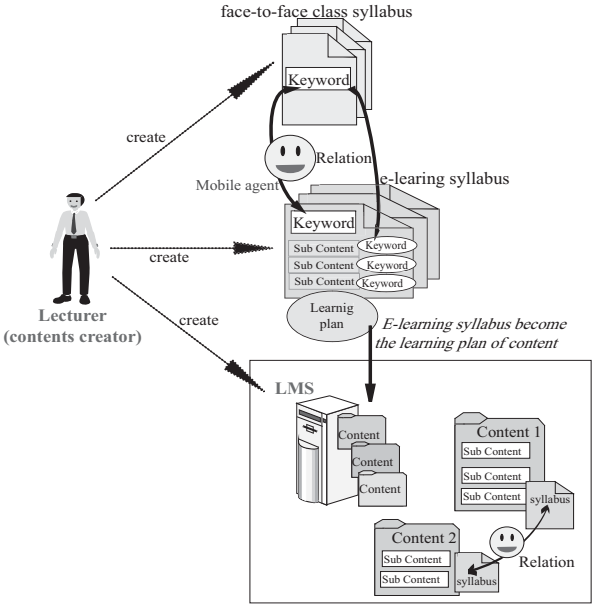

Figure 3. Functions for the lecturer.

The (F1-1) and (F2-1) could be realized by using SCORM2004 (Sharable Content Object Reference Model) of the newest standards for the e-learning system. Thus, the contents can be created in a small page unit and can be defined by a detailed rule. However, we must solve difficulties that the time and work cost increase.

Then, the (F2-2), it is possible to search the contents which a learner requests by using NIME-Glad LOM (Learning Object Metadata)[5][7], only search of one contents unit can be performed. Therefore, we introduce the syllabus for e-learning and the mobile agent in order to realize these functions.

The remaining functions (F1-2) can be realized by the comparison of each syllabus.

We propose the mobile agent with these functions and offer the cooperation supports shown in Chapter 2.

3.2 Functions for cooperation(1)

The flow of Cooperation(1) is shown in Figure.3. A mobile agent for each contents and a mobile agent for each face-to-face class are created. Each mobile agent is given each syllabus as a agents's policy. An agent searches for agents with the same keyword as itself. If several agents are found, all agent's contents name (or a face-to-face class name) will be set to the item of "Related subject" of the agent's policy and the syllabus.

3.3 Functions for cooperation(2)

The flow of Cooperation(2) is shown in Figure.4.

1. A learner confirm an e-learning syllabus. The learner recognize attainment target and learning policy of contents.
2. The learner learns select the contents in LMS.

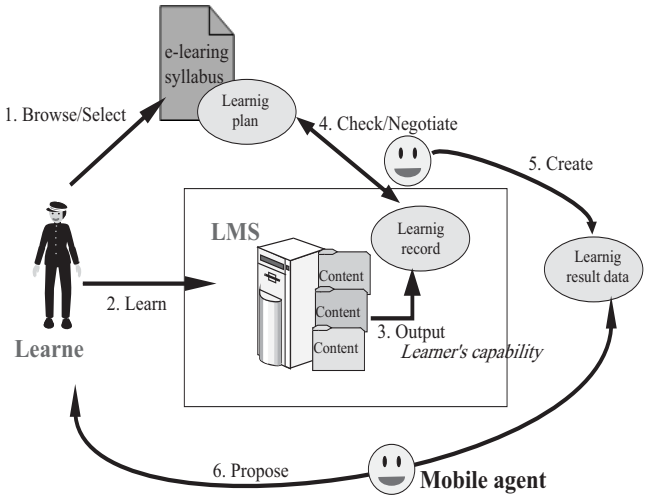

Figure 4. Functions for the learner.

3. A learner's learning record is created by LMS.
4. A mobile agent compares the learning plan with the lerner's learning record.
5. The mobile agent creates a personal learning result.
6. The learner checks own learning result and can know progress in e-learning and own capacity.

3.4 Calculation of the attainment degree

Variables are given as follows.

A number of subcontents are N_s ($i = 1, ..., N_s$), A number of attainment targets are N_a ($j = 1, ..., N_a$).

Degree of attainment target in subcontents i is $grade_i$, Weighted of every attainment target in subcontents i are w_{ij}(see Figure.2(3)), maximum point in subcontents i is sec_max_score, point allocation in subcontents i is sec_score, pass point in subcontents i is sec_pass_score.

$$grade_j = \sum_{i=1}^{N_s} (w_{ij} \times \frac{sec\_max\_score_i}{sec\_score_i})$$

The judgment formulas of fass-fail.

$$sec\_max\_score_i > sec\_pass\_score_i$$

This calculation method is also included in the policy of the mobile agent.

4. Conclusion

In this paper, we designed and applied the cooperation support agent performing the blend of face-to-face class and e-learning. In this system, the syllabus was used as a learning plan given to the mobile agent. A lector and a learner are experienced in syllabus use. Therefore, this system can have an easy user interface.

We will estimate the learning effect from the learning record, and then, investigate the availability of our system.

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