A Support System for Viewing Lecture Contents Adapted Students Understanding - Study on Question Behavior to Grasp Learner's Understanding Situation -

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Abstract. We developed a lecture content viewing system using lecture content metadata. The lecture content viewing system developed by us has the function to reproduce the lecture contents based on the index and the function to reproduce the unit and learning contents of the lecture contents. However, it is necessary to grasp the scene that the learner himself/herself wants to learn, then it has not reached support of adaptive learning. In this research, we develop a lecture content recommendation system that supports adaptive learning based on learner's understanding. In this paper, we focus on the learner's questioning behavior as a method of grasping the learner understanding. We describe the survey of learner experiences using journey map and the chat function that encourages question behavior in learning using lecture contents.

Keywords: Lecture contents · Adaptive learning · Question behavior

1 Introduction

We developed the lecture contents viewing system using lecture contents metadata [1, 2]. The system which we developed has three functions, index function, unit/content viewing function and playlist function. The index function can view lecture contents from utterance time of indexing term by using index metadata. The unit/content viewing function can be played back selected unit and learning content of lecture content by using syllabus metadata generated from the syllabus. The playlist function can view plural units and learning contents continuously. This system provides various mechanism of viewing lecture contents on learning.

In recent years, attention has been paid to adaptive learning which provides learning according to learner understanding situation. Adaptive learning is a form of

learning that measures learning progress and understanding degree of each learner and provides learning according to learners. There are quizzes and reports as methods for measuring learner understanding situation after learning. There are questions behavior as a method to measure understanding of learners during learning.

The lecture content viewing system developed by us does not have much function on support of adaptive learning. For example, there is a function to recommend learners learning next, and a function to encourage learning of units which is the premise of learning. In this research, we develop a lecture content recommendation system that supports adaptive learning based on learner's understanding.

In this paper, we describe the survey of learner experiences using journey map and the results of the survey using the journey map. In addition, we describe the psychological burden on the learner's question behavior and the chat function that encourages question behavior in learning using lecture contents.

2 Lecture Contents Viewing System Using Lecture Contents Metadata

Lecture contents metadata consist of index metadata and syllabus metadata. The index metadata is generated from text data, which is converted by teacher's utterance in lecture contents using a voice recognition technology. Figure 1 shows index metadata. In Index metadata, the information of lecture contents describe contents tags, indexing term describe term tags and utterance time of indexing term describe time tags. Figure 2 shows that the user can directly enter in the input form if the word which user wants to search is clear. Figure 3 shows the result, when it is stored in the database. In order to realize the index system, the contents created by this system don't need the play back from the beginning but from the midstream. The Syllabus metadata is generated from the Syllabus. Figure 4 shows the Syllabus metadata. Ac-cording to Fig. 4, the lecture contents JAD02 consists of various units and learning contents. This Unit consist of encoding of information and information content. This learning content consist of information transmission and symbol and code. The lecture contents can be played back selected units and learning contents by using syllabus metadata. In this research, the authors use SMIL (Synchronized Multimedia Integration Language) [3] of markup language. Using SMIL, we can create a video combined various multimedia such as moving image data, image data, sound data, and text data. Figure 5 shows SMIL file generated by playback of units and learning contents function. According to Fig. 4, the lecture contents JAD02 playback unit of information content from 1905 s to 3008 s. These information are based on syllabus metadata which the author defined in this research.

3 Measurement Method of Learning Achievement

The syllabus is a learning plan for lectures and lessons. It is a memo which incorporates all the necessary information concerning each lecture attendance. For example, the name of the lecture, the name of the teacher in charge, the number of credits to be

```
<contents name="JAD02">
   <index>
      <term name="Encoding">
         <time>00:04:39</time>
      </term>
      <term name="Symbol">
         <time>00:07:32</time>
         <time>00:14:12</time>
         <time>00:46:08</time>
         <time>01:07:29</time>
         <time>01:07:54</time>
      </term>
      <term name="Codeword">
         <time>00:08:03</time>
         <time>00:12:11</time>
         <time>00:46:08</time>
      </term>
      <term name="Length of code">
         <time>00:10:23</time>
      </term>
      <term name="Average code length">
         <time>00:10:37</time>
         <time>00:25:46</time>
      </term>
      …
   </index>
</contents>
```

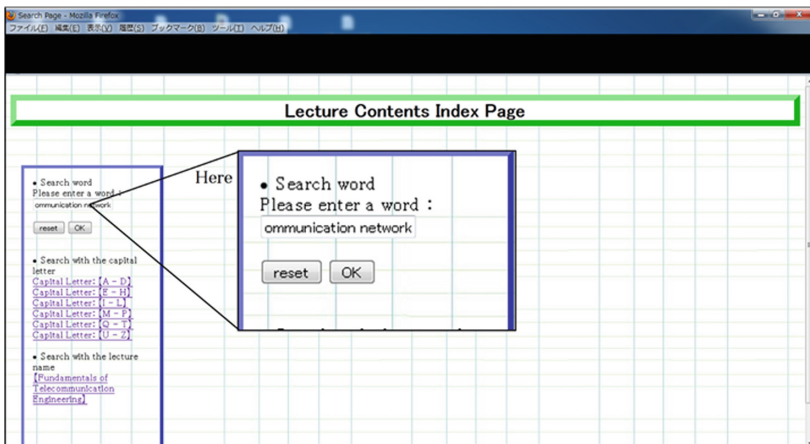**Fig. 1.** The index metadata

Fig. 2. Search

taken, the period during which the lecture is held, the textbook, the purpose of the lecture, the subject of the lecture, the goal by the lecture, the grading evaluation method, etc. are described in syllabus of the university. Also, most universities are

Fig. 3. Result

```
<lecture title=" Fundamentals of Telecommunication Engineering">
  <unit id="1">
    <unitstart>00:00:00</unitstart>
    <unitend>00:31:45</unitend>
    <unittitle>Encoding of Information</unittitle>
    <content id="1">
      <contentstart>00:00:00</contentstart>
      <contentend>00:06:41</contentend>
      <contenttitle>Information Transmission</contenttitle>
    </content>
    <content id="2">
      <contentstart>00:06:41</contentstart>
      <contentend>00:09:57</contentend>
      <contenttitle>Symbol and Code</contenttitle>
    </content>
…
  </unit>
  <unit id="2">
    <unitstart>00:31:45</unitstart>
    <unitend>00:50:08</unitend>
    <unittitle>Information Content</unittitle>
…
  </unit>
…
</lecture>
```
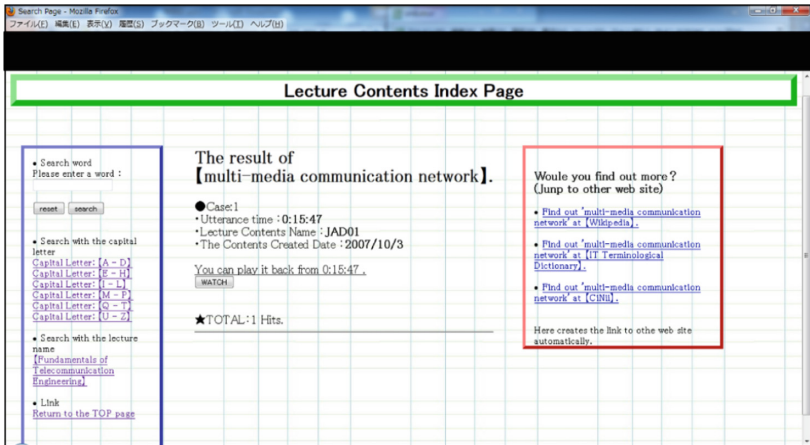
Fig. 4. The syllabus metadata

currently publishing the contents of syllabus on the Web. Therefore, it is an effective tool for students to select lectures.

Learning achievement is an index which can show how much students achieved the goal of the lesson set for syllabus by learning. Learning achievement is used to verify whether students achieve the goal set for syllabus. The result of learning achievement is

```
<smil>
    <head>
       <layout>
          <region id="1" width="480" height="320"fit="fill"/>
       </layout>
    </head>
    <body>
       <video clip-begin="1905s"clip-end="3008s"
         src="JAD02.rm" title="Information Content"region="1"/>
    </body>
</smil>
```

Fig. 5. SMIL file generated by playback of units and learning contents function

also expected to be an effect that leads to learner's next learning. There are three major educational functions for the purpose of evaluating grades by using learning achievement. The first purpose is to provide opportunities for students to review themselves and to verify understanding of the lecture. The second purpose is to provide opportunities for students to confirm their level of understanding. The third purpose is to provide opportunities for students to acquire more motivation to learn. Also, lectures at universities are generally conducted based on syllabus. This also applies to educational video content (lecture content) such as e-learning.

In the measurement method of learning achievement, appropriate methods are used for measuring the knowledge area, the attitude area, and the skill area, respectively. In addition, the measurement method of learning achievement has several methods depending on the learning objectives. These methods are classified into two major types: tests (objective test, in-class essay exam, oral test, practical test) and reports (paper, report). Table 1 shows the types of the measurement method of learning achievement according to learning objectives. There are objective tests and in-class essay exam and reports as the measurement method of learning achievement used in general e-learning. Quiz tests (objective tests, in-class essay exam) can measure knowledge, understanding, ability to solve problems, etc. Reports can measure knowledge, analytical skills, descriptive power, logic, information gathering ability, creativity and so on [4]. In addition, the measurement method of learning achievement is not only implemented after lecture execution but also it may be used to grasp learner understanding during lecture. For example, it is also possible to grasp the learner understanding from question behavior that the learner performs during lecture as a method similar to the oral test, or the attitude and atmosphere of the learner during lecture as a method similar to the practical test. It is possible to grasp learner understanding by the score of the quiz. On the other hand, it is difficult to grasp learner understanding by question behavior, because there is existence/nonexistence of implementation of question behavior for each learner. It is stated that there are four steps in the process until the learner performs question behavior. The first step is "perception of learning tasks" that individuals understand learning tasks in lectures. The second step is "question raising" that is suspicious of what learners are learning. The third step is "Generate Question" to convert questions that are occurred into languages and generate questions. The final step is to "act behaviors of questions" that

actually makes the generated questions words to other people [5]. In this research, we focus on a method (question behavior etc.) to grasp learner understanding.

Table 1. The measurement method of learning achievement according to learning objective.

Measurement method of learning achievement		Learning objective
Objective test	○ × Format, Multiple choice question	Knowledge, Understanding, Ability to solve problems
In-class essay exam	Drawing problem	Knowledge, Understanding, Ability to solve problems
Paper/Report	Discussion along the theme	Knowledge, Analytical skills, Descriptive power, Logic, Information gathering ability, Creativity
Oral test	Examination by interview	Knowledge, Understanding, Ability to solve problems, Communication skills
Practical test	Evaluation by observation record of actual behavior	Ability to solve problems, Skill, Perspective, Custom, Creativity, Applied skill, Communication skills

4 Survey of Learner Experiences Using Journey Map

4.1 Journey Map

In this research, we created a journey map to investigate learner experiences in lecture. A journey map is one of methods for examining the design of the entire service by visualizing the user image (persona) and the overall image of the service, the experience used between the user and the service [6]. In this survey, three students from Faculty of Engineering, Kagawa University were conducted as subjects. Subjects created a journey map by replacing the service with a lecture. Table 2 shows the set persona. By creating a journey map, it was possible to express the flow from the start of lecture to the end of lecture about a set persona as a chart. In addition, subjects described the specific touchpoints (points of contact between the user and the service) during lecture on the journey map and the interaction at touchpoints. In the journey map, it was possible to express the user's emotions as interaction and a result of interaction. Figure 6 shows a journey map which created in this survey.

4.2 Consideration of Learner Experience Using Journey Map

Table 3 summarizes some of learners' action, thoughts/emotions, tasks, and solutions for each touchpoint of a journey map. Figure 7 shows overview of journey map created. In this survey, each subject changed the emotional change from the start of lecture to the end of lecture by curves (emotional curves). At this time, the start of the emotional curve starts from 0, and it doesn't specifically designate the way of finishing and quantitative index. In touchpoints from the emotion curve set by the persona before

Table 2. Persona set up.

| Sex	Man
Age	21 years old
Organization	College student
Department	Faculty of Engineering
Part time job	Kitchen staff of the restaurant (the third year)
Hobby	Social gaming, Web surfing
Room layout/Living arrangements	1K/Alone
Relations with teacher	Relations that can't be greeted
Q&A session during a lecture	He has a question but he can't hand it
Reasons	He is concerned about the evaluation of the surroundings
Motivation of lecture	He seats a seat before starting lecture He is sitting alone in the seats and listening to music with earphones until the beginning of the lecture
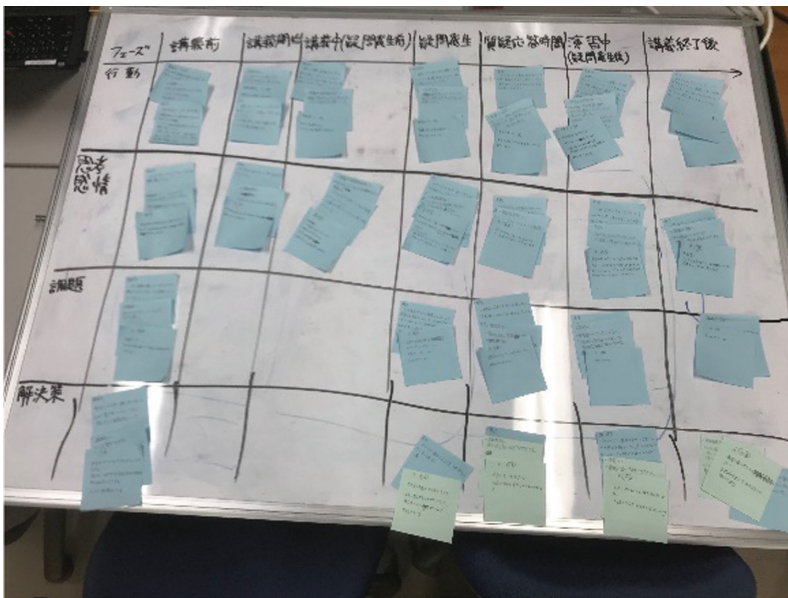
Fig. 6. Journey map

lecture to the end of lecture, it was able to be read that the feelings were biased in the minus direction in common with them at the stage when learner noticed a question. From this here, it is conceivable that some sort of psychological burden exists at the question generation stage during learning in this persona. Table 3 extracts more detailed behavior, thought/emotion, problem, solution of persona from the journey

Table 3. Journey map excerpt

Touchpoint	Before lecture	Start lecture	During lecture (Before doubt)	Doubt
Action	Sit in the corner of the classroom.		Learn according to the pace of the lecture.	Don't understand but do a board work.
Thoughts / Emotion				Let's revisit a little before because they don't know.
Problem				Not good at standing out.
				There is no one who can consult around.
Solution				

Touchpoint	Q & A time	During exercises (After doubt)	After the lecture ends
Action	Wait for someone to ask a question.		
Thoughts / Emotion	Hate it being my own doubt. Don't want to be watched. Don't want my teacher getting angry.		They are ashamed to go and ask the teacher's teacher. Let's review it at home.
Problem		Despite being able to ask questions individually during exercises, they can't question by carefully evaluating teachers.	They can't ask the teacher individually for questions.
			They left the classroom right away.
Solution	There is no need to ask questions during the lecture.	Ask someone other than the teacher.	They ask questions individually to the teacher at the time other students return so as not to be noticed.
	It would be nice if there was a way to ask the teacher anonymously.		Ask questions by means other than meetings such as e-mail.

map. It is stated that learners set for persona are not going to solve the problem due to gaze from others in each touchpoint. In particular, touchpoint such as questioning, questioning and answering time, after the end of lecture can be mentioned. Based on Fig. 7 and Table 3, the learner is able to clarify the question and language of the question. However, it has been shown that there are cases where they hesitates questioning behavior (questioning by the learner to the teacher) due to a psychological burden caused by consciousness of other people think and evaluation etc.
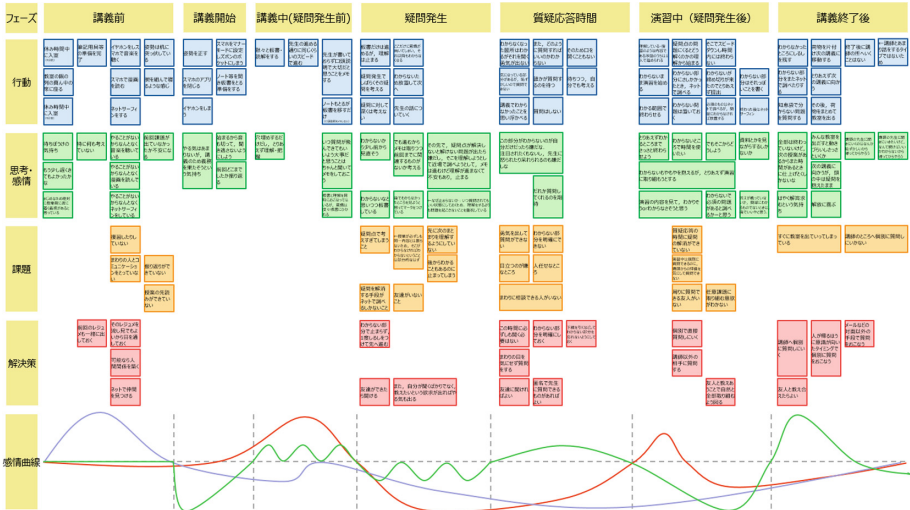

Fig. 7. Overview of journey map

5   Chat Function to Encourage Questions Behavior

In a general lecture, learners compensate for their understanding by asking teachers about the content of which understanding is insufficient. Learners are reported to worry about other people's thought and evaluation, and it is reported that there are cases where they may hesitate asking quest by psychological burden [5]. In this research, we propose a chat function in order to reduce the psychological burden of learners and promote question behavior in learning using lecture contents.

The scenario of the chat function will be described below. In the chat function, the chat bot will ask the learner about questions on lecture at an arbitrary scene of lecture contents. Next, the learner answers the question from the chat bot. After lecture content viewing, the chat bot asks the learner about questions about lecture contents. If the chat bot function can automatically answer questions, the chat bot will automatically answer. When the chat bot function can't answer automatically for questions, the chat bot records as learner understanding data, and the teacher in charge answers questions. The purpose of the chat bot function is to reduce the psychological burden on question behaviors of lecture contents by making dialogue with the chat bot before questioning lecture contents to the learner.

6   Conclusion

In this paper, the results of the survey using the journey map and the journey map aiming at grasping the psychological situation during lecture of the learner were described. In addition, we described the psychological burden on the learner's question behavior and the chat function that encourages question behavior in learning using lecture contents.

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