

## CASE STUDIES FOR SELF-DIRECTED LEARNING ENVIRONMENT USING LECTURE ARCHIVES

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### ABSTRACT

The main topic addressed in this paper is to support graduate students of diverse backgrounds to take basic courses, before joining a research group to specialize in a particular field. In order to realize effective graduate education, we have developed two types of lecture archives system which systematically store actual lectures in School of Information Science and deliver them as complementary learning materials on the campus network. This paper describes overview of the lecture archives systems in 2005 and 2006, and reports on the case studies of the lecture archives systems. The results of students' questionnaires indicate those effectiveness and some future tasks.

### KEY WORDS

Graduate Education, Lecture Archives, Complementary Learning Materials, Self-directed Learning

### 1. Introduction

Japan Advanced Institute of Science and Technology (JAIST in short) was founded in 1990 as the first independent national university to carry out graduate research and education in science and technology in Japan. For this purpose, the students are encouraged to take some basic courses, before joining a research group to specialize in a particular field. Our admission is open to all students who have a strong motivation to advance their knowledge and ability regardless of the undergraduate background. To facilitate the students from diverse backgrounds, one of the important issues of our education is to increase chance of learning with a broad background and interest to be adaptable to the quickly changing world of science and technology today.

Our approach is to improve in quality of our graduate-level education through blending traditional (face-to-face) lectures and application of multi-media and network technology in order to encourage students' initiative. Research Center for Distance Learning (DLC in short) is cross-departmentally carrying out such activities with respect to distance learning and/or e-learning in JAIST.

In this paper, we report a case study of the lecture archives system in 2005 promoted by DLC including overviews of the system, trends of students' access to the

system, and results of students' questionnaires. We also describe overviews and results of preliminary questionnaires of new lecture archives system in 2006, which reflects the findings of the use case of the previous lecture archives system.

### 2. Lecture Archives

#### 2.1 What are Lecture Archives?

In this paper, lecture archives mean visual and acoustic streaming data recording face-to-face lectures in lecture room, in which a learning management system (LMS in short) stores, delivers and retrieves systematically through IP network. Figure 1 shows an example of our lecture archives. The main purpose of the lecture archives is to increase reviewing opportunities for the students who take the actual lectures. Important steps for the development of the lecture archives systems are as follows.

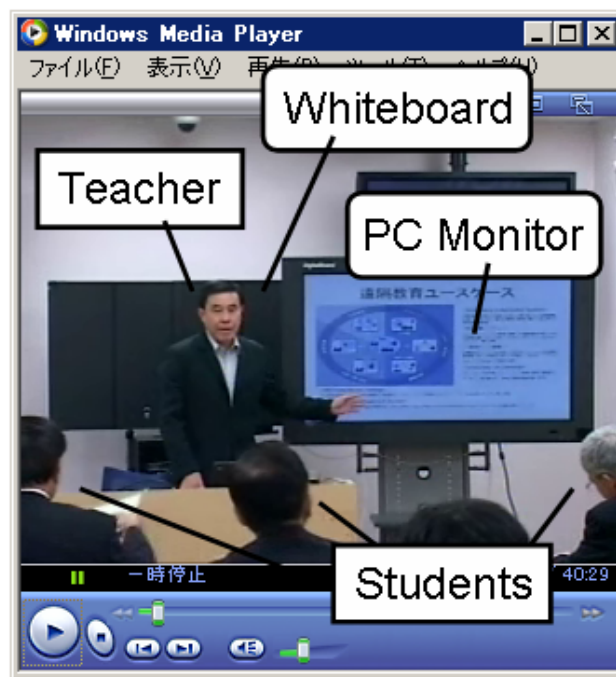


Figure 1. An Example of Lecture Archives

#### Recording of Actual Lectures:

In the actual lecture, a teacher uses diverse educational media such as whiteboard, screen and/or monitor for PC

presentation, and communicates with the students in the various ways. In order to review the lecture by using the lecture archives effectively, deciding what to record the lecture is important for designing the system. On the other hands, establishing such recording activities as services of university needs to reduce burden imposed on the teacher and operational costs of the services. Therefore, deciding how to record the lecture is also important.

**Encoding and Uploading of Recording Data:**

In order to distribute the recording data as on-demand streaming data, we have to specify the media format of the lecture archives. In some applications of the lecture archives, for example, the students may require to edit the archives to be of practical use or to upload and register the archives immediately to be of reviewal use. Considering bit rate of the lecture archives and compatibility with operation system and web browser on the receiving end is also important for specifying the media format.

**Online Distribution:**

LMS is an infrastructure of our online distribution of the lecture archives, which gives the students access to the lecture archives, supports the effective collaboration between teacher and students, and manages student information effectively. The target of the online distribution is campus network because most students of JAIST live in student residence on the campus.

**2.2 Related Approach**

MIT OpenCourseWare (OCW in short) is one of the most famous projects of delivering free and open Web-based educational resources from MIT's undergraduate and graduate courses [4]. MIT OCW provides MIT's course materials such as syllabus, lecture notes, streaming video lectures and web interactive demonstrations for educators, students, and self-learners around the world. On the other hand, degree-granting activity is not focused on MIT OCW. The target of our lecture archives project is to increase reviewing opportunities for the students who take the actual lectures. For this reason, the lecture archives require to provide appropriate information from the actual lectures, which deliver streaming videos in the campus network.

Web-based training (WBT in short) system is another approach to increase opportunities of learning, which is self-contained courseware using Web technology. Figure 2 shows the interface of a prototype WBT system in JAIST Virtual University Project [5]. The WBT system is often used for purposes of degree-granting and credit transfer. Therefore, it generally provides high quality contents including slide information and indexes based on a course structure. However, WBT contents are often cost and time expensive for development and operation. Our first approach is focused on distributing visual and

acoustic data of the face-to-face lectures in order to reduce development/operational cost and time.

Developing effective lecture archives is required continued efforts for improvement like instructional design approach [3]. Therefore, we developed the lecture archives system as the first stage of the project at June, 2005. As the next stage of the project, we are now developing and promoting new lecture archives system based on reflection on the previous system evaluated by the students through a use case in actual environment.



Figure 2. Interface of WBT System in JAIST Virtual University Project.

**3. Lecture Archives System in 2005**

**3.1 System Overview**

Figure 3 shows main procedure from recording to distribution of the lecture archives.

**Recording of Actual Lectures:**

Recording staffs who were student workers set up a digital video camera in the back of lecture room. The camera angle was basically fixed on the whiteboard or the screen for PC presentation. The teacher taught mostly the same as normal lectures, except that s/he talked through a wireless microphone. Such visual and acoustic data were recorded in MiniDV tape. There were up to 4 lectures at the same time in School of Information Science.

**Encoding and Uploading of Recording Data:**

DLC staffs converted the MiniDV tapes collected from the lecture rooms into Windows Media format. Default bit rate setting was 750Kbps. Updating the data on the LMS and Media Server was usually completed by a few days after the actual lectures.

**Online Distribution:**

We adopted exCampus [1] as LMS of the lecture archives system on Redhat Linux AS 3.0 and Windows Media Server as streaming server on Windows 2003 server. The

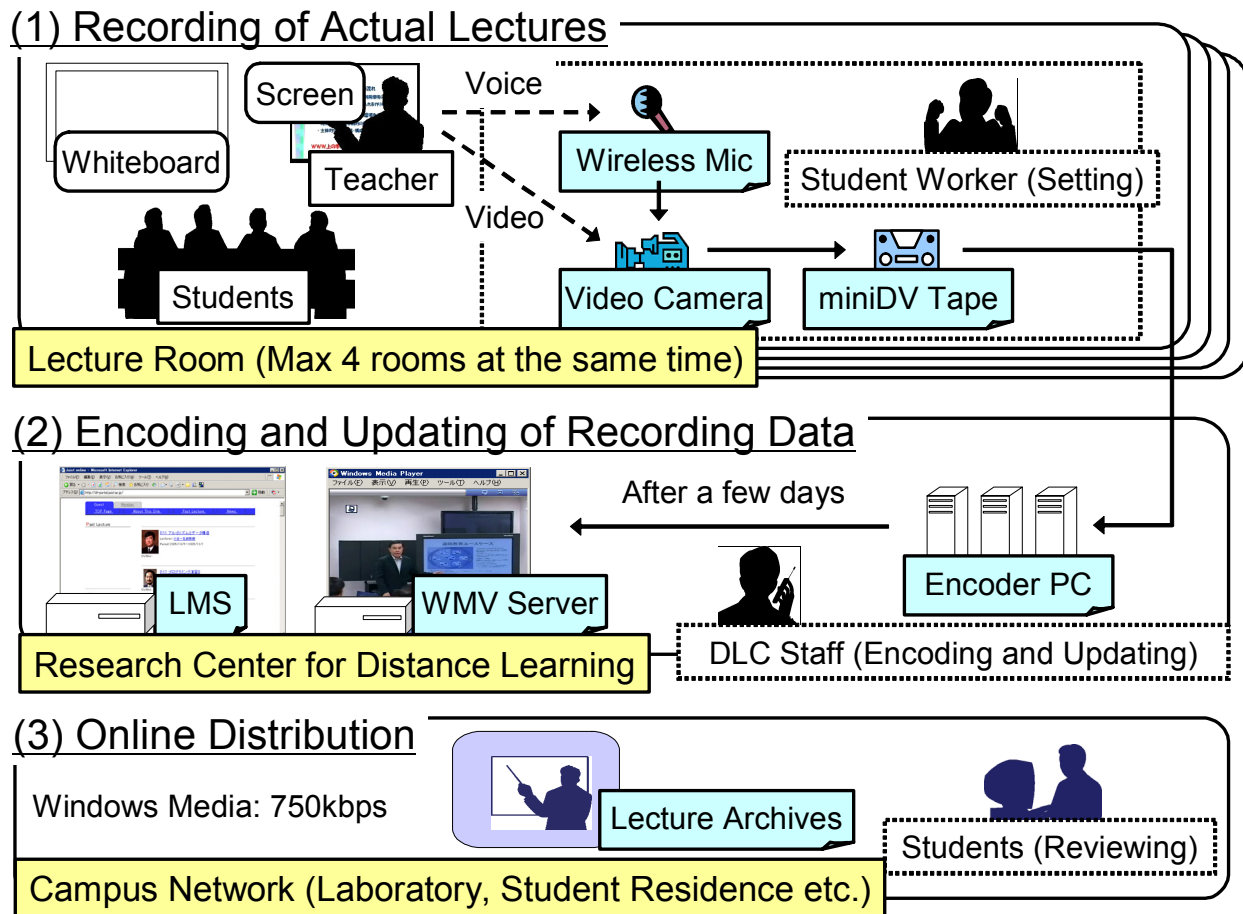


Figure 3. Lecture Archives System in 2005.

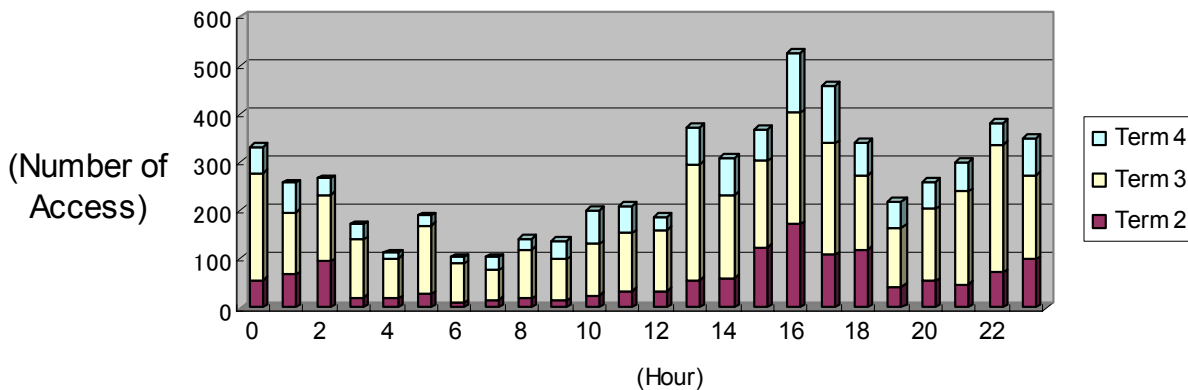


Figure 4. Access Trends to Lecture Archives.

exCampus is open source LMS and manages on-demand lecture videos and other course material. The exCampus also runs BBS forums and manages user information and profiles and so on but we used only the function of the online distribution. The students could watch the streaming lecture archives anytime from the campus and the student residences without user authentication.

### 3.2 Use Cases and Access Trends

This lecture archives system stored 492 lectures of 39 courses in School of Information Science and delivered on the campus network from June 2005 to February 2006. The number of freshman students in School of Information Science was 130. The number of recoding staffs was 42.

The average of access to the lecture archives was 51.2 times per day during the service period. Figure 4 shows access trends every one hour. This indicates that there are

two peaks of access at evening and midnight. In JAIST, most of the lectures were held in the morning. The system would accordingly contribute to increase the opportunities of learning other than the actual lectures time.

### 3.3 Results of Student Questionnaire

Figure 5 shows results of student questionnaire about the lecture archives system. The respondents were 44 graduate students in School of Information Science, JAIST. The respondents were asked to rate the satisfaction of the system on a five point scale. The scores from 1 to 5 indicate very low, low, ordinary, high and very high, respectively.

We could see that the values of satisfaction were high except for video quality and distribution schedule. The fixed camera angle and low resolution video data were the major causes of the difficulty in reading information of the whiteboard or the screen on the video. However, we need consideration for additional operational costs to solve this issue. The low evaluation of the distribution schedule would indicate that the students require uploading and registering the archives immediately in their reviewal use.

Major comments from the free description reply of the respondents were as follows.

- The archives should record voice of speakers other than teacher such as student's question related to the lecture.
- Rich interface of the archives such as the indexes might be important for easy-to-review the video.
- It was better to provide not only streaming distribution but also PodCasting.

## 4. Lecture Archives System in 2006

### 4.1 System Overview

Second lecture archives system has been developed, which reflects the findings of the use cases of the previous system. The system is in operation now and already stored 420 lectures of 31 courses in School of Information Science and delivered on the campus network from April 2006 to September 2006. Figure 6 shows main procedure from recording to distribution of the lecture archives.

#### Recording of Actual Lectures:

In the previous system, the recording staffs were assigned to each actual lecture. In order to reduce such setting tasks, ceiling-mounted digital video camera and four wireless microphones were installed in all lecture rooms in School of Information Science. The camera angle was basically fixed on the whiteboard. The microphones recorded not only teacher's voice but also students' voice if necessary. Two encoder PCs were also installed in the rooms. One could record visual and acoustic data from the ceiling-mounted camera and the microphones, the other could record screen of teacher's PC as shown in Figure 7. Such PC screen information would be expected to resolve the issue of difficulty in reading PC presentation on the video. The ceiling-mounted cameras were controllable via campus network but we did not control them at this time.

#### Encoding and Uploading of Recording Data:

Recording, Encoding, and Uploading of the lecture archives are automatically executed by encoder PCs according to the schedules DLC staffs set in advance. Default formats of two types of the videos in the lecture archives are MPEG4 AAC (1Mbps) or Windows Media format (1Mbps). The archives had a rich interface including the video data of the ceiling-mounted camera, the video data of PC screen information, and time indexes every 5 minutes. Uploading the archives on the LMS was usually completed by a few minutes after the actual

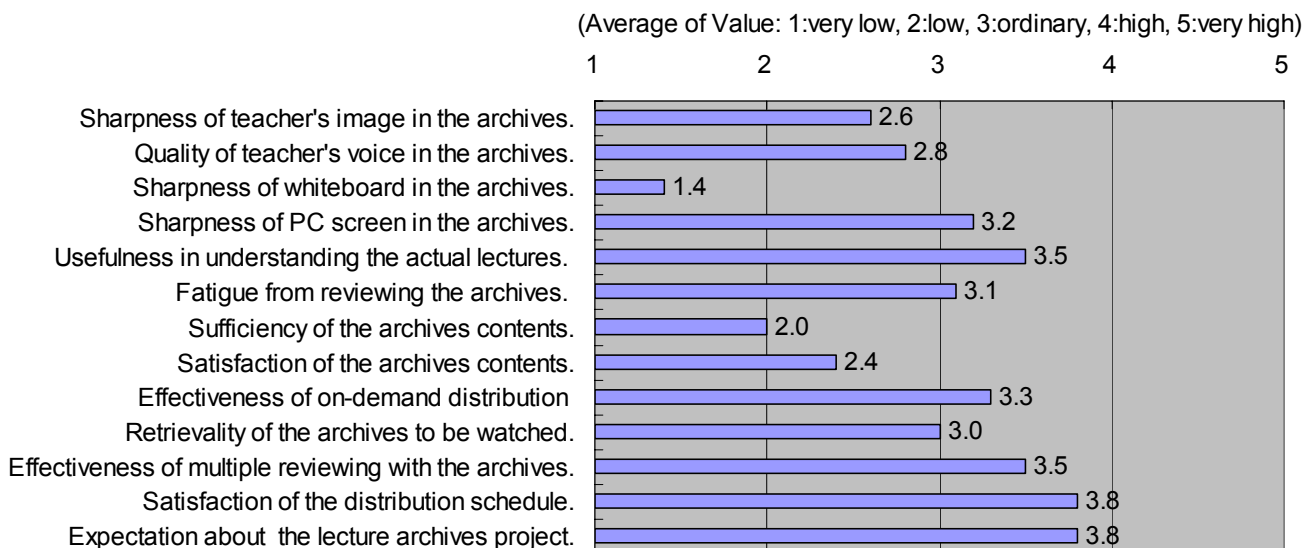


Figure 5. Results of Student Questionnaire in 2005

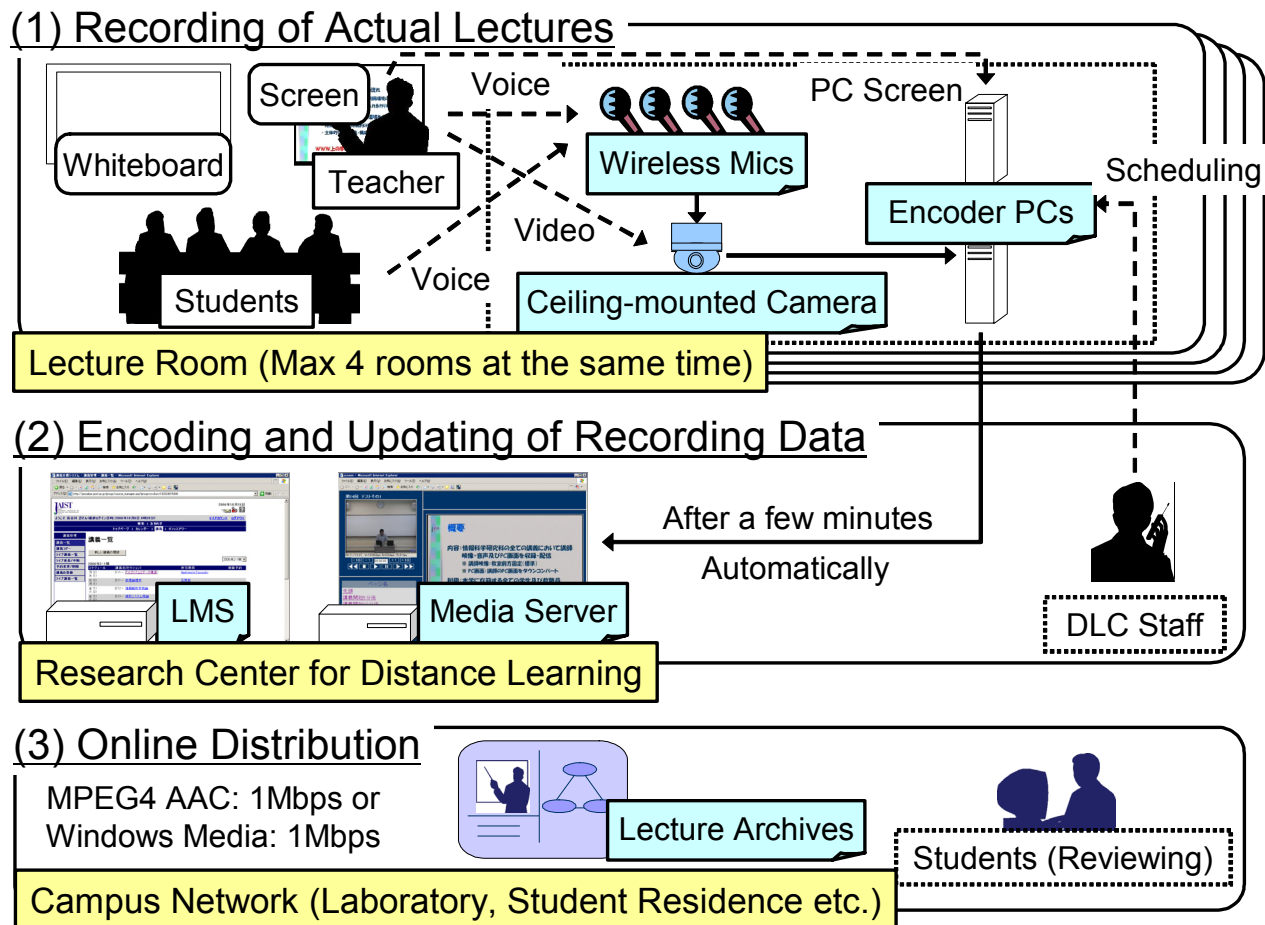


Figure 6. Lecture Archives System in 2006.

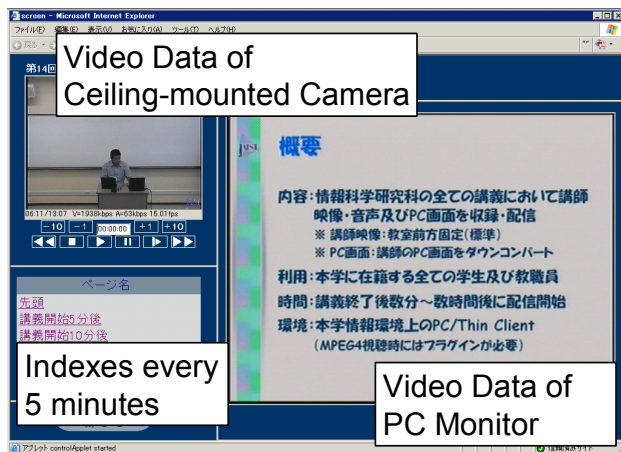


Figure 7. Rich User Interface of New Archives

lectures. Such automation enables us to operate without the student workers and to resolve the issue of the distribution schedule.

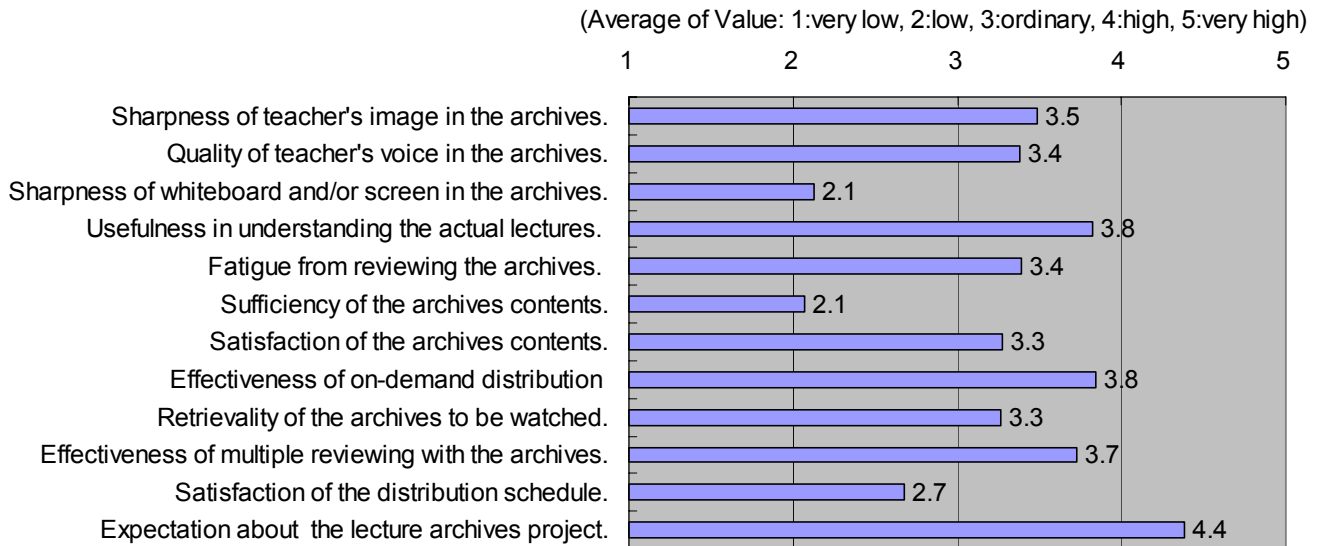
#### Online Distribution:

We adopted Jenzabar [2] as LMS of the lecture archives system on Windows 2003 Server, OKI Media Server as MPEG4 streaming server on Redhat Linux AS 3.0, and

Windows Media Server as Windows Media streaming server on Windows 2003 server. Jenzabar manages on-demand lecture videos and other course material, runs BBS forums and manages user information and profiles and so on. It provided only the function of online distribution of the lecture archives at this stage. The student's account information was stored on the existing LDAP (Lightweight Directory Access Protocol) server. The system authenticated logins by referring to the account information on the LDAP server. The students could watch the streaming lecture archives anytime from the campus and the student residences.

#### 4.2 Results of Preliminary Student Questionnaire

Figure 8 shows results of preliminary student questionnaire about the new lecture archives system. The respondents were 25 graduate students in School of Information Science. The respondents were asked to rate the satisfaction of the system in the same way as the previous questionnaire except for the question of "Sharpness of whiteboard and/or screen in the archives". This question was divided into "Sharpness of whiteboard in the archives" and "Sharpness of PC screen in the



**Figure 8. Results of Preliminary Student Questionnaire**

archives" due to the evaluation of the video data of PC monitor.

This results show that some existing issues were resolved but other issues were caused by the system upgrade. Especially, reading information of whiteboard might be more difficult because the video data of the ceiling-mounted camera was low resolution in the new user interface of the lecture archives. We have already developed a new function which enables the students to interchange the ceiling-mounted video with the PC monitor video. We will evaluate its effectiveness in the future work.

We have some comments from the free description reply of the respondents as follows.

- There were some archives without acoustic data. (It is a negative effect of the automatic recording because the recoding staffs were not assigned each lecture.)
- The archives were incompatible with web browser other than Microsoft Internet Explorer. (It is a negative effect of the rich user interface because of javascript incompatibility due to link between time-codes of two video data).
- The movements of the leaser pointer during the actual lecture could not read on the archives. (It is an advanced issue for the video data of the PC monitor.)

## 5. Conclusion

In this paper, we have reported two use cases of the lecture archives systems in 2005 and 2006. Although investigation of the educational effects of the lecture archives is not enough, the results of the student questionnaire show that the lecture archives are expected to increase reviewing opportunities for the students who

take the actual lectures. Professors in School of Information Science generally accept this project but some of them have concerns that the system might decrease actual lecture attendance.

The lecture archives have potentials not to increase reviewing opportunities for the students but to acquire a volume of expert knowledge and to support Faculty Development activities. In the future, we would like to develop a more effective system with concerns about advantages and disadvantages of the lecture archives and some communication functions such as BBS forums.

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