

Evaluation of Distance Learning Course shared by UCLA and Kyoto University

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Abstract

In this article, we report our analysis of how the evaluation of distance learning system is affected by its performance, the experience for the lecture, and the cultural difference of students, based on the questionnaire about distance learning between Kyoto University and UCLA for three months. Analysis of questionnaire clearly reveals the follow things. The feeling of sharing the same classroom is very important to make students satisfied. With the repeated experiences of the distance learning, students tend to shift the focus of evaluation from the system to the contents of the course. For the difference in the behavior to attend a lecture, the students of UCLA evaluate the system for understanding the lecture, whereas the students of Kyoto University evaluate it for atmosphere of the class.

1. Introduction

The rapid advancement of the Information Technology(IT) such as the Internet has been changing education, particularly distance learning becomes very popular in higher education. Distance learning is a system and a process that connects learners with distributed learning resources. Since distance learning is becoming one of the most important lecture styles in higher education, it is necessary to clarify what factors are important to improve the evaluation of distance learning courses by the students.

The distance learning is classified into two types. One is asynchronous learning system such as Virtual University[1]. In this type, archived lectures are delivered to students through the Internet so that the students can watch the lectures anytime and anywhere asynchronously[2][3]. The other is synchronous learning system such as distance lecture. In this type, video images of lecturer and the classroom are delivered synchronously[4], so this type encourage interaction.

In this article, we report our analysis of how the evaluation of distance learning system is affected by (1)its performance, (2)the experience for the lecture, and (3)the cultural difference of students.

The first issue is about improvement of the system. It is shown in the previous work on this issue that there are two crucial factors for distance lecture system: the quality of images and interactivity[4][5]. In our work, we verified whether this result is still held when we use advanced distance lecture system in which the two factors are much more improved than the previous system.

As the second objective of our work, we focus on how students change their evaluation about distance learning during a course. Through the wide spread of distance learning in higher education, many distance lectures are going to be offered. However, most of the previous work that dealt with evaluation of distance lecture system, does not consider the change of students' evaluation during distance the course of lectures.

When the distance lectures between countries are offered, difference in behavior to attend a lecture has to be considered. As the third objective of our work, we clarify difference of behavior in lecture.

We have started TIDE (Trans-Pacific Interactive Distance Education) project[6], which is a collaborative project among University of California Los Angeles (UCLA), Kyoto University, and Nippon Telephone and Telegraph Corporation (NTT), in the autumn of 1999. The distance lecture system for this project has high quality of video images and slight delay in their transmission by MPEG2 for video encoding and ATM network with QoS for video transmission. About 40 students of each university shared the same course given by the professors of the two universities for three months continuously. Considering these features of the distance lecture, the evaluation was done from the viewpoint about how the students' satisfaction with the course is affected by the performance of the system, the students' experiences of distance learning and the students' behavior to attend the lecture. Research methods are the statistical analysis for questionnaire replied by the students.

In the remainder of this article, we will first explains about TIDE project in section 2. In section 3, we will describe our analysis of questionnaire, in which the students answered about the evaluation of distance lecture.

In section 4, we will discuss the result of the analysis. We will give our concluding remark in section 5.

2. TIDE Project

2.1 Distance Lecture System

In each classroom of UCLA and Kyoto University, 4 shooting cameras, 2 screens, some microphones, personal computers and electronic whiteboard are prepared for distance lecture. Figure 1 describes the figure of the classroom of Kyoto University, and Figure 2 shows that of UCLA.

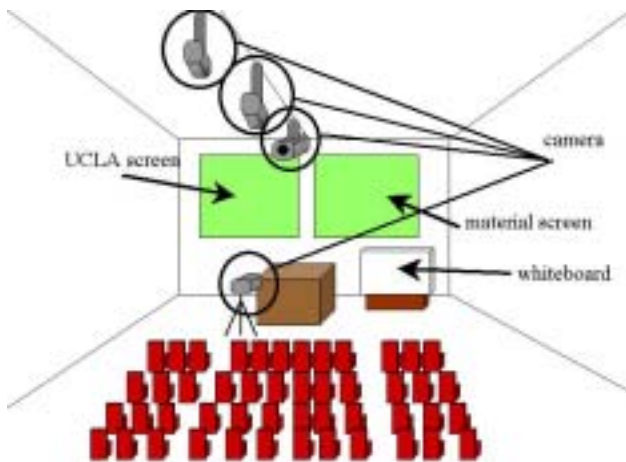


Figure 1 Classroom of Kyoto University

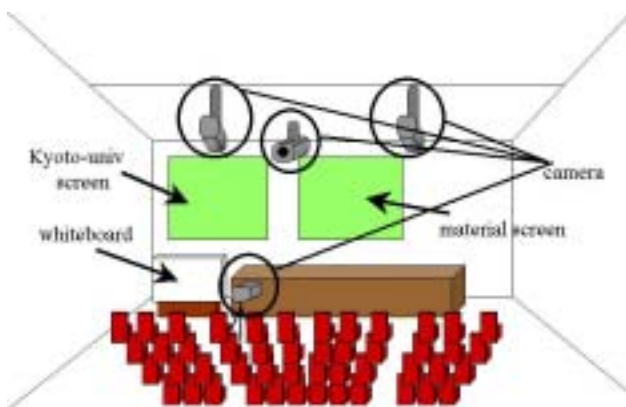


Figure 2 Classroom of UCLA

The video images of the other classroom are displayed on one of the screens. The cameras in each classroom are selected and controlled by computers using image processing technology[7] or by a human operator in order to capture the best shot of the room at any given moment. Some microphones are prepared so that students can ask

the lecturer a question directly. The audio and image information are encoded with the MPEG2 standard, and transmitted to the other classroom (see Figure 3)

As shown in Figure.4, the network configuration is composed of Kyoto University Integrated information Network System(KUINS-II), NTT Global Enhanced Multifunctional Network(GEMnet), and the California Research and Education Network(CalREN2). CalREN2 is a normal internet line and the others employ an exclusive ATM(Asynchronous Transfer Mode) line that guarantees QoS of 5Mbps. As the result, the delay for encoding, transmission and decoding of video data was kept below 500ms in each way, and thus did not interfere with communication between the classroom of Kyoto University and UCLA.

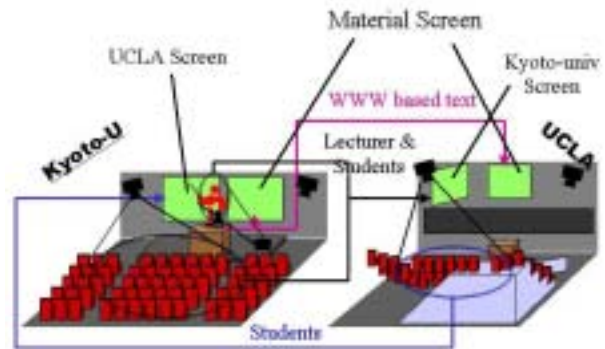


Figure 3 Composition of distance learning system

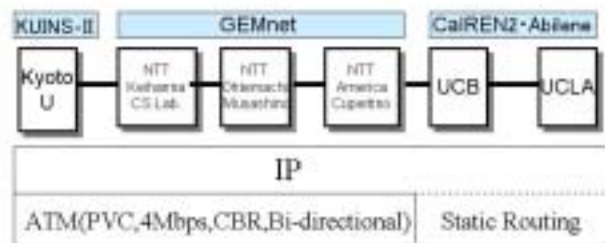


Figure 4 Network configuration

Teaching material which is given as slides, electronic whiteboard and video is shown by the other screen. The slides is prepared as HTML files and displayed on a screen in each classroom over the Internet. Since the electronic whiteboard can detect position and color of the

writing marker, what is drawn on the whiteboard is displayed on the screens in real time.

2.2 Courses

By using this distance lecture system, two courses between Kyoto University and UCLA were offered from October to December 1999. Both the courses were conducted in English as basic courses for freshman and sophomore. Figure 5 shows the view of the distance lecture in the classroom of Kyoto University.

One course is titled “Physics for Poets”, for which two lectures are given per week. These lectures are given by a professor of UCLA using a textbook and the electronic whiteboard.

The other course is titled “Space Science”, for which one lecture is given per week. Two professors, one from UCLA and the other from Kyoto university gives the lectures using Web material, alternatively per week.

These distance lectures have the characteristic that the students communicate not only with professors but also among students in the class.



Figure 5 A snapshot of the class in Kyoto University

2.3 Methods

In order to evaluate this distance lecture, we used a questionnaire. The questionnaire consists of two parts. One part consists of 24 questions, which are on a 5-point scale with the rating as follows: 1(Strong Disagree), 2(Disagree), 3(Uncertain), 4(Agree) and 5(Strong Agree). The same questions were given the students of both universities. The other part of the questionnaire is free space, in which the students could write comments freely.

We asked the students in both courses to answer the questionnaire using WWW. The students are asked to answer the same questionnaire in an early stage and a late

stage of the course period. The results of questionnaires are classified by the universities and the stages. The number of students who returned their answer based on this classification is shown in Table 1.

Table 1 Numbers of answers

	Early	Late	sum
UCLA	51	40	91
Kyoto	23	23	46
Sum	74	63	137

3. Results

In this section, we reported the results of statistical analysis for the questionnaire.

3.1 Mean

First, mean of ratings for every question was calculated for each university and each stage. The results are shown in Figure. 6. From the fact that most of questions are given high ratings, it is considered that the students give good evaluation for these lectures. By using t-test, the difference in ratings between universities and stages was examined. The questions are shown in Figure 6 in which the rating that is significantly different is shown with the stars.

3.2 Factor analysis

Since the ratings of question 22 and 23 can be regarded “the satisfaction of the system”(SOS) and “the satisfaction of the course content”(SOCC) respectively, we measured “the satisfaction of the course”(SOC) by the average rating of No.22 and No.23. The major factors that affect the evaluation of the course by the students are extracted by factor analysis with varimax rotations. We use 22 questions except No.22, No.23 as dependent variables. The results are shown in Table 2.

As the result of factor analysis, we extracted the five factors: “interactivity”, “quality of teaching material”, “camera switching”, “feeling of sharing the classroom” and “instability to the system”. The interactivity(factor 1) describes about the interaction between the lecturer and the students by questions and answers. The quality of teaching materials(factor 2) describes how easy the students understand the lecture with teaching material. The Camera switching(factor 3) explains about the evaluation of automatic camera system, especially evaluation whether choice of images by the system is appropriate or not. The feeling of sharing the classroom(factor 4) describes the

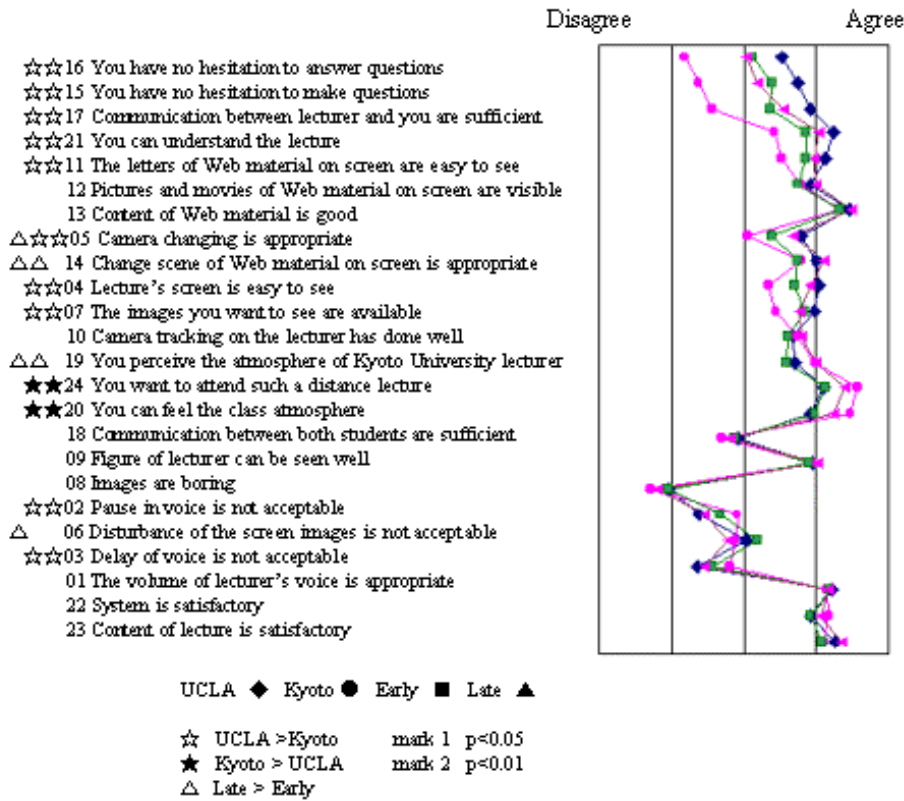


Figure 6 mean of question
Tabel 2 Results of factor analysis

	Factor	Question	
1	Interactivity	16 You have no hesitation to answer questions	0.89
		15 You have no hesitation to make questions	0.88
		17 Communication between lecturer and you are sufficient	0.78
		21 You can understand the lecture	0.54
2	Quality of the teaching material	11 The letters of Web material on screen are easy to see	0.74
		12 Pictures and movies of Web material on screen are visible	0.72
		13 Content of Web material is good	0.62
3	Camera Switching	05 Camera changing is appropriate	0.79
		14 Change scene of Web material on screen is appropriate	0.61
		04 Lecture's screen is easy to see	0.60
		07 The images you want to see are available	0.56
		10 Camera tracking on the lecturer has done well	0.55
4	Feeling of sharing the classroom	19 You perceive the atmosphere of Kyoto University lecturer	0.74
		24 You want to attend such a distance lecture	0.73
		20 You can feel the class atmosphere	0.70
		18 Communication between both students are sufficient	0.46
		09 Figure of lecturer can be seen well	0.38
		08 Images are boring	-0.60
5	Instability of the system	02 Pause in voice is not acceptable	0.80
		06 Disturbance of the screen images is not acceptable	0.60
		03 Delay of voice is not acceptable	0.59
		01 The volume of lecturer's voice is appropriate	-0.41

atmosphere of the classroom obtained through the distance lecture system. The instability of the system(factor 5) describes the disturbance of audio and visual data by trouble of system such as packet loss. These five factors account for 57.0% of the variance of proportion.

We defined that “factor score” was average of the rating for those questions that constitutes the factor.

3.3 Regression analysis

Regression analysis was conducted in order to know how each factor effects the SOC measured by question No.22 and 23. In this analysis, independent variable was factor score, and dependent variable was the SOC. Standardized regression coefficients were shown in the left-most column of Table 3 by this analysis. All regression coefficients are statistically significant ($p < 0.05$), it can be regarded that all five factors have relationship with the SOC.

Further, regression analysis was conducted in each university and each stage of the course. Standardized regression coefficients were shown in the other column of Table 3 by this analysis.

3.4 Multiple regression analysis

In order to describe the relation between the five factors obtained by the factor analysis in 3.2 and the satisfaction described in 3.2 more clearly, multiple regression analysis was conducted. Standardized partial regression coefficients by this analysis are shown in Table 4. As the result of the multiple regression analysis, the following relations are obtained.

The SOS has strong positive relation with factor 4. The

SOCC has positive relation with factor 1 and factor 4, and has negative relation with factor 5. The factor 5 is not affected by the system but by the course content. The SOC has positive relations with factor 4 and factor 1 and has negative relations with factor 5.

4. Discussion

In this chapter, we discussed how the evaluation of the distance lecture course is affected by the difference of universities, the experience to attend the course, and the performance of the system from the results of analysis described in section 3.

4.1 Improvement of performance

From the result in 3.1, distance lecture was in general given a good evaluation by the students. Since similar results are reported in the previous work, it is expected that distance lecture will become quite useful as one of the educational styles in higher education.

From the result of factor analysis in Table 2, we extracted five factors. Since the factor 1 affects on the SOCC in 3.4, it can be thought that improvement of the quality of images and interactivity affects on the evaluation by the students.

It is important that the factor 5 does not affect on the SOS, but the SOCC. It means that, when distance lecture system works with sufficient quality of image and interactivity, the instability of the system has a weak relationship with the SOS, whereas it gives bad effect on the evaluation for the course. Considering these facts, for the design of distance lecture system, it was important to consider the stability of the system.

Table 3 Standardized regression coefficient of factor score

	Course	Early	Late	UCLA	Kyoto
Interactivity	0.351	0.322	0.382	0.458	0.568
The quality of material	0.256	(0.107)	0.414	0.487	(0.089)
Camera control	0.256	0.304	(0.168)	0.303	0.273
feeling of sharing the classroom	0.608	0.561	0.637	0.530	0.732
instability of the system	-0.227	-0.257	(-0.143)	(-0.123)	-0.361

Table 4 Standardized partial regression coefficient of factor score

	System	Content	Course	Early	Late	UCLA	Kyoto
Interactivity	(0.014)	0.291	0.170	(0.172)	(0.162)	0.231	0.226
The quality of material	(0.072)	(0.095)	(0.099)	(0.003)	(0.228)	0.331	(-0.043)
Camera switching	(-0.026)	(0.004)	(-0.013)	(0.051)	(-0.092)	(-0.052)	(0.102)
feeling of sharing the classroom	0.575	0.319	0.537	0.484	0.544	0.329	0.579
instability of the system	(0.023)	-0.229	-0.147	(-0.144)	(-0.138)	(-0.059)	-0.199

4.2 Experience of attending the distance lecture

From the result shown in 3.3, as the students get used to the distance lecture by attending the same course, the effect of the factor 3 and the factor 5 on the SOC decrease, whereas the effect of the factor 2 increases. It means that the long stability of the distance lecture system makes students to feel the distance lecture quite usual. In this situation, the relation between SOC and the SOS was weakened, although the evaluation about the system itself is still high. With the repeated experiences of the distance learning, students tend to shift their focus of evaluation from the system to the contents of the course.

When the distance lecture is exercised for a long period, it is important to guarantee the stability of the system rather than to improve the performance of the system further. Since teaching material is very important for lecturers and students under this situation, we need to design teaching material for students to understand more easily.

4.3 Cultural difference

From the result in 3.4, the students of Kyoto University is affected more by the feeling of sharing the classroom, the interactivity and the instability of the system than the others, whereas the evaluation by UCLA students are affected more the quality of teaching materials, the feeling of sharing the classroom and the interactivity than the others.

It follows from these results that the UCLA students evaluated distance lecture from the viewpoint whether they can understand the lecture easily, whereas the students of Kyoto university evaluated distance lecture from the viewpoint whether they can feel the atmosphere of the sharing classroom sufficiently.

The UCLA students gave higher ratings on the interactivity than the students of Kyoto University. We think this difference is caused by cultural difference between the students in Japan and the US for the behavior to attend a course. It means that this difference in the behavior of the students to take a class should be considered when we evaluate the priorities of each property of distance lecture system in its design.

5. Conclusion

We reported in this paper the evaluation of distance lecture from the viewpoint of how the students' satisfaction with the course is affected by the performance of the system, the students' experiences of distance learning and the students' style to take the class.

The following results are obtained through the evaluation:

- Improvement of the quality of images and interactivity affected on students' satisfaction
- The students become to pay less attention to camera control and stability of the system, on the other hand, more attention to the quality of teaching materials when they get used to the distance learning.
- The students of UCLA give more weight on the quality of teaching materials and interactivity while the students of Kyoto University put more weight on the feeling of sharing the classroom.

In future work, we need to discuss how the teaching material for distance lecture is designed and developed for the students to understand easily. It is also necessary to work on the evaluation for asynchronous system such as Virtual University.

Reference

- [1] Ryan, S., Scott, B., Freeman, H. &Patel, D. "The Virtual University", Kogan Page,2000
- [2] Okawa, K. Kato, A. Gast, G. Atarashi, R. Toyobe, Y. L.H.Landweber, Murai, J. "Global collaboration for the joint University course on the next generation Internet", INET2000, 2000
- [3] Hiltz, S.R., Coopola, N., Rotter, N. and Turrof, M., "Measuring the Importance of Collaborative Learning for the Effectiveness of ALN: A Multi-Measure, Multi-Method Approach", ALN Journal, Vol.4, Issue 2, 2000
- [4] Ui, Osamu., Nakayama, M. and Shimizu, Y.,"Evaluation of Two Different Delivery Systems for Distance Education by Satellite", D-II,Vol.J80-D-II,No.4,pp892-899,1997
- [5]Tamura, T., Kaminishi, Y. and Sato, F., "Evaluation of Multi-Media Distance Education System and Study of the Optimum Learner Interface", Vol.34, No.6, pp1236-1245, 1993
- [6] Yagi,K. Kameda, Y. Nakamura, M. Minoh, M. M, A, Abdalla. " A Nobel Distance Learning System for the TIDE Project " , ICCE2000, Vol.2, pp1166-1169(2000)
- [7]Kameda, Y., Ishizuka, K., Minoh, M., "A Study for Distance Learning Service -TIDE Project-", IEEE International Conference on Multimedia and Expo, Vol.3, pp.1237-1240, 2000.