

Distance Lecture Based on Instruction with Blackboard

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Abstract

"Instruction with Blackboard" is one of traditional lecture styles. In this style, the instructor explicates contents with writing the main point on the blackboard. This style has been enough considered as instructional method. We design a style of distance lecture based on Instruction with Blackboard. This style provides a teaching environment wherein the instructor gives a lecture without getting used to new computer applications. For investigating features of distance lecture based on this style, we constructed a distance lecture system and a studio wherein an instructor can teach using a blackboard. This paper reports the model of Instruction with Blackboard and distance lecture based on the model.

1. Introduction

Recently, information network such as Internet has been rapidly developed, so that there have been a lot of academic research and educational activities about distance education. Especially, many distance lectures using computer-based presentation tools are practiced. On the other hand, traditional style of lecture requires blackboard. In the style, instructors construct her/his lecture with writing educational contents. We call this style "IB2: Instruction with BlackBoard" hereafter. In this paper, we put emphasis on the style of distance lecture based in IB2.

IB2 is not actually new idea as educational method. However, this style was not good way for constructing distance lecture so far, because existing slow-speed network could not realize transmission of high-quality image of written contents on blackboard. As for the alternative way, instructors use computer-based presentation tools which restrict heavy data transmission on their distance lectures and this style. This means IB2 is not major style but also new style on distance lecture. However, we can easily use high-speed network such as Gigabit Network for transmit high-quality image of blackboard. Therefore, we can realize IB2 style of distance lecture by using high-speed network. We have a chance to select various style of distance lecture by such technological innovation. On

the other hand, this recent change of instruction style on distance lecture requires appropriate selection of lecture style based on target domain, teaching strategy and so on. We believe that it is important for distance lecture to give the selection policy. In this viewpoint, we analyze IB2 style of distance lecture[1].

In addition, we constructed a pseudo studio for instructors to practice distance lecture based on IB2. An instructor gives a lecture in this studio and her/his students watch the lecture at other lecture room. We practiced IB2 style of distance lecture twice. The distance lecture system captures high-quality image of the instructor and the blackboard by DV(Digital Video) camera and transmit the high-quality image and sound by DVTS[2]. We use LAN(100Mbps) for transmission. After each distance lecture, we obtained opinions of the students by questionnaire survey and confirmed IB2 style was effective for distance lecture.

2. Distance lecture based on IB2

Using blackboard or whiteboard is very popular in general lecture. On the other hand, the lecture style using presentation tools is getting increased recently. In this paper, we call the former "writing style of lecture" and the latter "projection style of lecture".

2.1 Writing style and projection style

Writing style of lecture has the following features:

- (A1) The instructor writes contents on the blackboard.
- (A2) If there is no space to write on the blackboard, the instructor erases and then starts to write again.
- (A3) The effect to stimulate the visual and auditory senses is generally poor.
- (A4) The instructor indicates the contents gradually.
- (A5) The special device is not necessary.

On the other hand, projection style of lecture has the following features:

- (B1) The instructor projects the contents by OHP, video projector and so on

- (B2) The contents can be indicated and changed at moment.
- (B3) If the instructor use computer-based presentation tools, s/he can use various kinds of effects to the visual and auditory senses
- (B4) Grouped contents can be indicated at moment and at a time.
- (B5) The projection device is necessary.

The feature of (B5) is a disadvantage of projection style of lecture. However, the projection device has widely spread recently so that we cannot insist on the superiority of writing style of lecture by only (A5) and (B5).

In addition, we can pick up the obvious differences between them in the following:

- (1) The speed for indicating educational contents, and
- (2) The amount of educational contents indicated at a time.

In the following subsections, we consider about educational meaning of these points and so on.

2.2 Educational meaning of indication speed of contents

Projection style of lecture reduces time to indicate educational contents compared with writing style of lecture. In this way, the former is very quick and the latter is slow as for the indication speed. Projection style of lecture uses the rest time for instruction based on the above-mentioned feature. We can say that projection style is educationally effective for discussion-based lecture, lecture meeting, and so on.

On the other hand, lectures oriented to knowledge transmission, help of understanding use blackboard or whiteboard and progresses like the following:

- (P1) The instructor writes educational contents on the blackboard.
- (P2) The students take notes of the lecture.
- (P3) The instructor explains the contents on the blackboard.

The typical lecture based on IB2 is constructed by cycle of these actions. Utilization of presentation tools in this style of lecture is also effective in the viewpoints of (B2) and (B3). This effectiveness comes from instructor side. However, reducing indication time (P1) prevents students from taking notes (P2). In addition, the time for student to understand the contents becomes short. If the instructor goes on the lecture without care of these problems, using presentation tools gives bad effect to student to understand. This means quick indication of educational contents is not always good way for student so that we must carefully select the style of lecture based on the purpose.

2.3 Educational meaning of amount of educational contents indicated at a time

Projection style of lecture indicates educational materials described on OHP sheets, slides, and so on at a time. They are generally grouped in a concept and are local-closed. On the other hand, the instructor writes one line each on the blackboard in the write style of lecture. The content of one line generally shows a piece of declarative or procedural knowledge (including facts) on a concept. Therefore, explanation of a concept is constructed by repetition of writing and explaining one-line content.

In this way, the projection style indicates educational contents at a time and the writing style indicates educational contents step by step for explaining a concept. We call the former indication "Macro-indication of educational contents" and the latter indication "Micro-indication of educational contents".

We think that macro-indication is effective for students to rough-understand of concepts with organizing knowledge and micro-indication is effective formalize concepts with building-up knowledge. For example, in writing style of lecture, students acquire new knowledge step by step through taking notes of micro-indicated contents.

As for time restriction of (P2) described in 2.2, it is one solution for reducing time to take notes that the instructor gives handouts to students in advance. However, the solution gives different effect to students compared with writing style of lecture, because handouts macro-indicate the contents in the viewpoint of amount of indicated contents at a time.

2.4 Lecture style and distance lecture

Recently, distance lecture using information network is getting actively practiced but the capacity of the network restricts quantity and quality of transmission data. Especially, image data (for example, contents written on the blackboard) transmission requires large capacity (or high-speed) of network. The existing popular solution does not send the raw or compressed high-quality image, but sends educational materials edited by presentation tools or stores them at the receiver side in advance. In this way, the default solution often selects projection style of lecture. However, it might be big problem that the instructor adopts projection style of lecture as the alternative way of writing style of lecture, according to discussion on 2.2 and 2.3. Therefore, we should not easily select projection style of lecture without thinking about the purpose of lecture and characteristics of educational contents.

Currently, research on gigabit network as next-generation high-speed network is getting active. In this high-speed network, we do not have to take care of net-

work capacity for realizing distance lecture with high-quality and large data transmission. This means that we can realize distance lecture based on IB2 by using high-quality image transmission of blackboard. In this way, we can add lecture style of IB2 (writing style of lecture) in the selection for style of distance lecture.

3. Distance lecture system focusing on IB2

This section describes a basic model of IB2 and an implementation model for the distance lecture. Fig. 1 shows the both models.

3.1 Basic model of IB2

We formalize IBS as data transmission model among objects existing in a lecture room. Fig. 1 shows the model. This model contains the following objects:

- (1) Blackboard/Whiteboard,
- (2) Instructor,
- (3) Teaching material, and
- (4) Students.

Teaching material does not include contents on (1) Blackboard/Whiteboard. All arrows in Fig.1 show image and sound data transmission among the objects. However, generally, sound data is sent and received only between (2) Instructor and (4) Students.

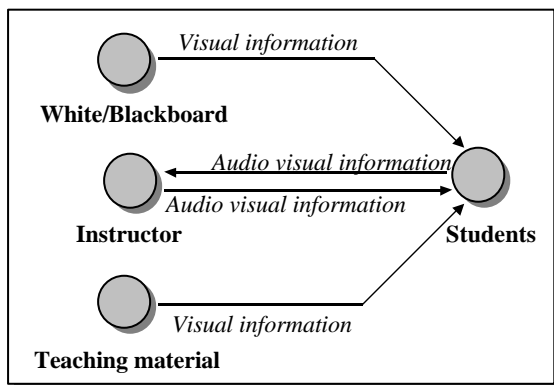


Figure 1 Model of Instruction with blackboard

3.2 Model of IB2-based distance lecture

We separate the basic model described in 3.1 into Instructor side and Student side and expand it as a data transmission model using transmitter and receiver via information network. We adopt this expanded model as the model of distance lecture based on IB2. This model is shown as Fig. 2.

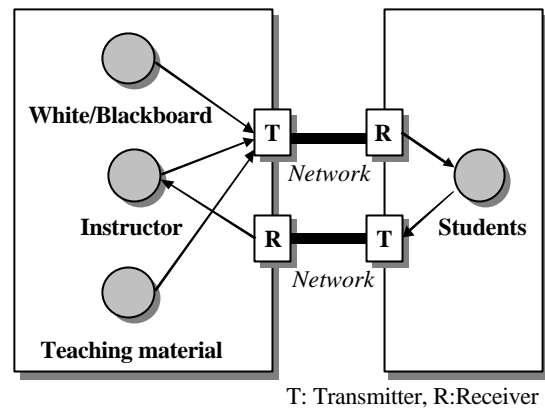


Figure 2 Model of distance lecture based on IB2

3.3 How to realize distance lecture based on IB2

This subsection shows a way to realize distance lecture described in 3.2. The transmitter can be generally constructed by combining a network-connected computer and a video camera with microphone. However, Digital video camera is appropriate for high-quality image transmission. On the other hand, the receiver can be constructed by a network-connected computer and a high-resolution video projector in the same way. In addition, high-speed network such as gigabit network is required for large data transmission. As for the location of distance lecture, the student side is required a lecture room where the transmitter and receiver can be located and the instructor side is required a studio for give her/his lecture (for example, an instructor room with transmission device and blackboard).

4. Experiment: distance lecture based on IB2

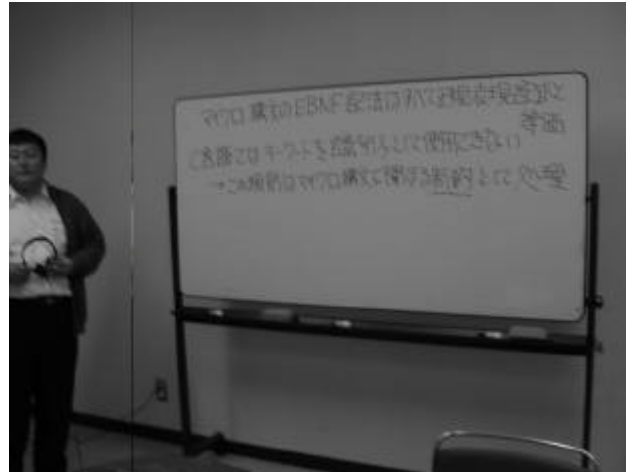
We practiced twice experiments of distance lecture base on IB2. The target lecture was "Compiler" opened for junior students of Department of Information Science, Faculty of Science and Engineering, Saga University. The snapshots of distance lecture are shown in Fig. 3.

4.1 Outline of experiments

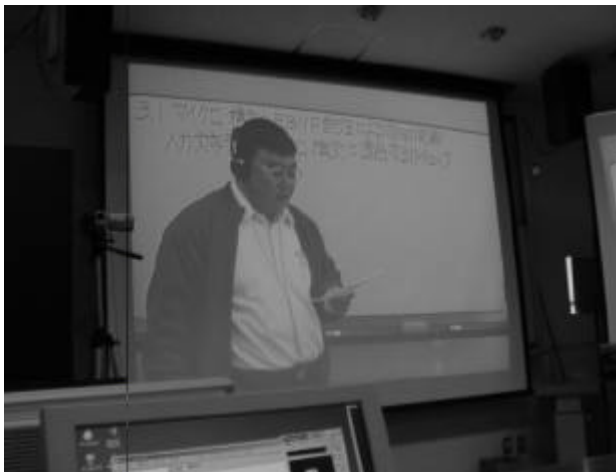
These experiments were practiced November 27th 2000 and January 15th 2001. As for the network environment of the experiments use LAN (100Mbps) which connects between an instructor room used as studio for distance lecture and a general lecture room with network device. In the studio, the instructor gave instruction about compiler technology (phase analysis mechanism) using white board and the student watched the situation in the lecture room.



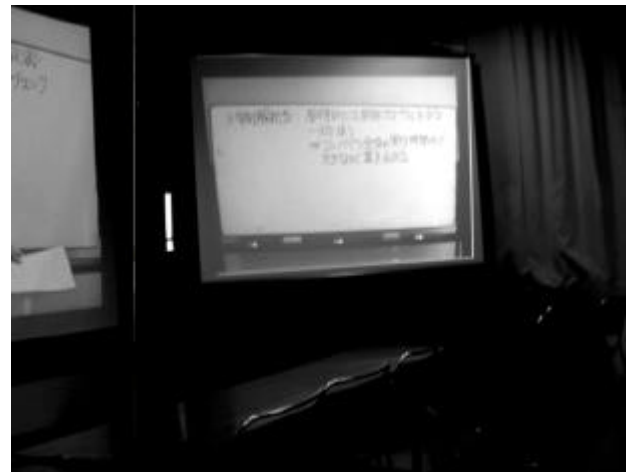
(1) Screen in studio(projection of lecture room)



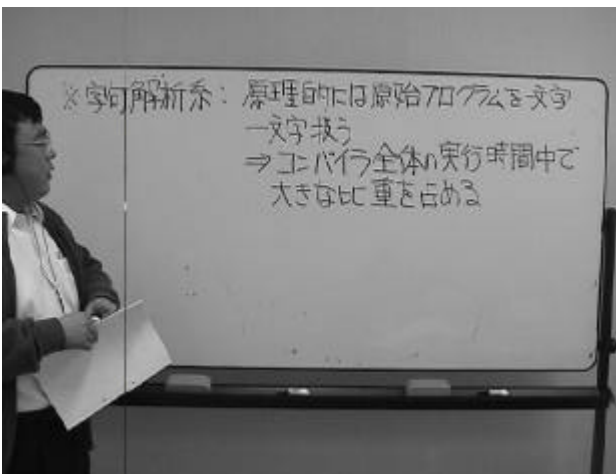
(2) Whiteboard in studio



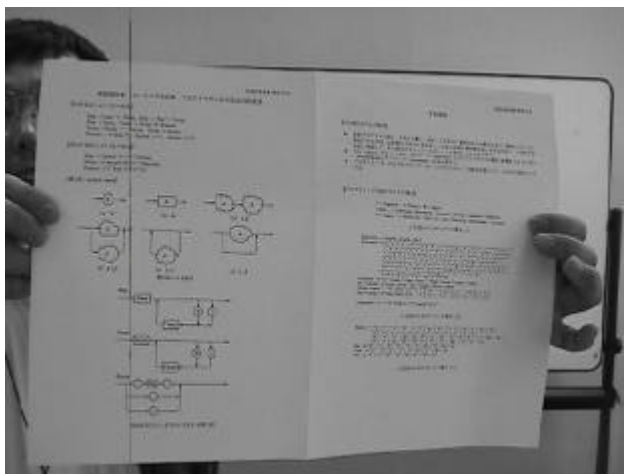
(3) Main screen in lecture room



(4) Sub screen(snapshot of whiteboard)



(5) Transmitted image of whiteboard



(6) Transmitted image of handout

Figure 3 Snapshots of distance lecture based on IB2

4.2 System configuration of distance lecture

4.2.1 System configuration of studio

We set a whiteboard shown in **Fig. 3** (2) in the studio and took the contents written on the whiteboard using a digital video camera. At first experiment, we used a special camera with object tracking function to take situation of the instructor. We got the instructor's voice by the microphone of the video camera. We projected the situation of the lecture room on the wall of the studio shown **Fig. 3** (1) by using video projector. The instructor monitored sound of lecture room using headphone. **Fig. 4** shows system configuration of the studio.

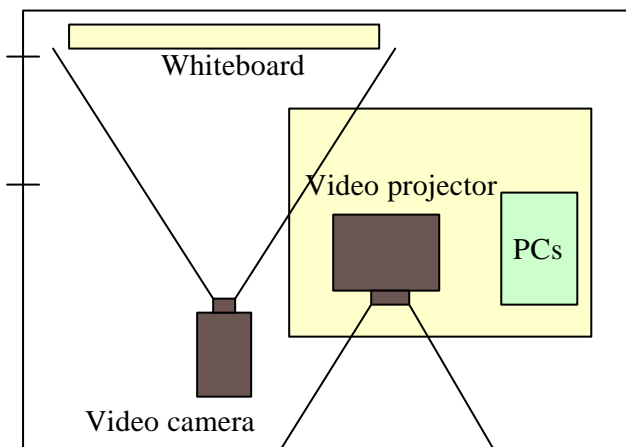


Figure 4 System configuration: studio

4.2.2 System configuration of lecture room

We set a big screen (called "main screen" hereafter) at front side (general instructor standing point) of the lecture room. The image of whiteboard in the studio was shown on the main screen and the voice of the instructor was played large-sized speakers in the lecture room. We also set a small screen (called "sub-screen" hereafter) at the front-right side of lecture room. We projected the situation of the instructor and previous situation of whiteboard before erasing. We also took the situation of students and sent image to the studio. **Fig. 5** shows configuration of lecture room.

4.3 Image and sound transmission in distance lecture

In our experiments of distance lecture, we used DVTS to send DV formatted image of whiteboard in the studio and the situation of students in the lecture room. The sound data is included in the DV formatted image. We connected two points by 100bps LAN to transmit high-quality image and sound. NetMeeting was also parallel used for small size of image transmission. In addition, system operators who supported experiments passed messages by using text-based chat system so that this traffic gave little influence at the whole data transmission.

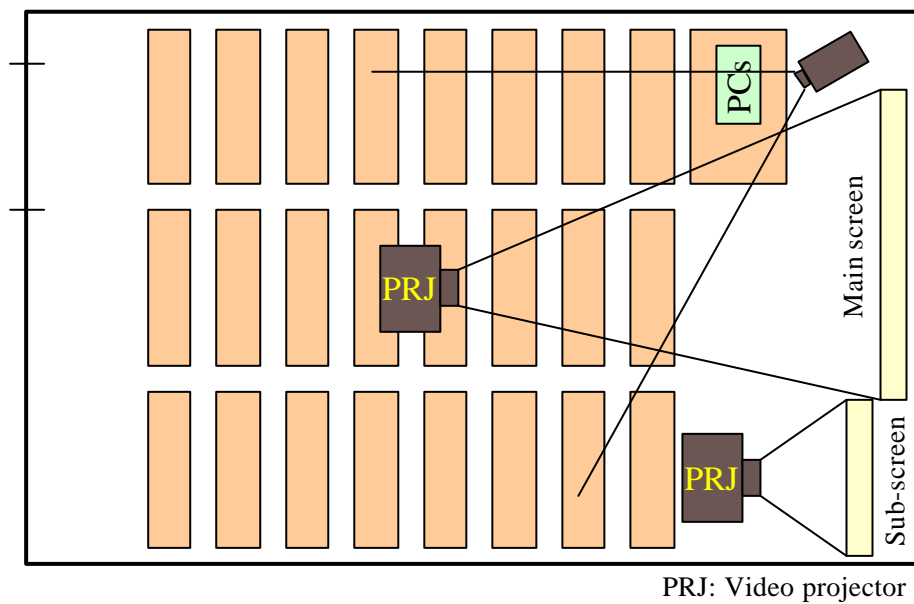


Figure 5 System configuration: lecture room

5. Summary

In this paper, we described analysis of distance lecture based in IB2 (Instruction with BlackBoard), models for the lecture, and the lecture experiments. Especially, we constructed a distance lecture system using digital video camera, high-speed network, and so on to realize transmission of high-quality image. After the experiments, we took questionnaire and confirmed that students had affirmative impression to our experimented lecture style. As for future work, we are going to use JGN[3] as real gigabit network for realizing distance lecture based on IB2 and confirm the educational effectiveness.

Reference

- [1] Hayashi, T., Otani, M., Tanaka, H., Akiyama, K., Inoue, M., Watanabe, K., Hayashida, Y. and Kondo, H.: "Remote lecture Based on Instruction with Blackboard Using High-Quality Image", *Technical Report of IEICE*, ET2000-142, pp.219-226(2001) *in Japanese*
- [2] "DVTS": <http://www.sfc.wide.ad.jp/DVTS/>
- [3] "JGN: Japan Gigabit Network":
<http://www.tao.go.jp/JGN/index.htm>