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Development of Instruction Monitoring System

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Abstract
The authors developed the Instruction Monitoring System (IMS) which could support a research project investigating and discussing instructional issues collaborating with a distant site during the lesson. The IMS encompasses benefit of live communication and monitoring method. The IMS is characterized by the Wireless Video Camera (WVC) that functions to transmit audio -video signal at a TV channel frequency, and it enables an user to move freely inside the classroom, and enables observers in distant place to monitor the lesson. The development study reported in this article investigates effects and applications of IMS through classroom tryouts. Identical video acquisition configurations of IMS were examined in a lifelong course of Tokyo Cosmopolitan Government. As results, 97.1 percent of views were successfully transmitted by WVC. In addition, interviews and discussions regarding effects of IMS were executed after each of seven sessions and findings were summed up.

Keywords
Classroom Monitoring, Collaboration, Instructional Skill, Teacher's View

1 Introduction

About 30 years ago, the classroom monitoring method that was supported by the closed circuit television system (CCTV), was developed by efforts of researchers in educational technology centers. The introduction of CCTV to college education was originally for connecting between an attachment school and the faculty of education with a cable and utilizing the live view for pre-teacher training. CCTV had had beneficial effects on educational researches or learning of instructional skills (Hoshino, 1965),

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however, this method was disappeared soon after. As the reason for this, a pioneer of CCTV in Japan, Prof. Hoshino stated the following as one of the reasons (Hoshino, 1996),

"We could not communicate between sites during a monitoring lesson, that is, CCTV was the one-way communication monitoring method. Therefore, it sometimes made communication troubles. Soon, Video Cassette Recorder (VCR) was developed with reasonable price, and teachers did not want to use CCTV any longer."

On the other hand, many researchers noted that VCR often became a passive learning medium where learners did not actively participate in the learning and hence simply "turn-off" to the instruction (Gendele and Gendele, 1984). Then, conventional observation ways has been used in the past decade.

Recently, live observation and video technologies have been merged to form system called as the Instruction Monitoring System (IMS) which could support a research project investigating and discussing instructional issues collaborating with a distant site during the lesson developed by the authors. The IMS encompasses benefit of live communication and monitoring method. The IMS is characterized by the Wireless Video Camera (WVC) that functions to transmit audio-video signal at a TV channel frequency, and it enables an user to move freely inside the classroom, and enables observers in distant place to monitor the lesson (Figure 1). Video acquisition by WVC can occur in multiple locations; cameras simultaneously, and the system can offer this benefit of the multiple views through one cable.

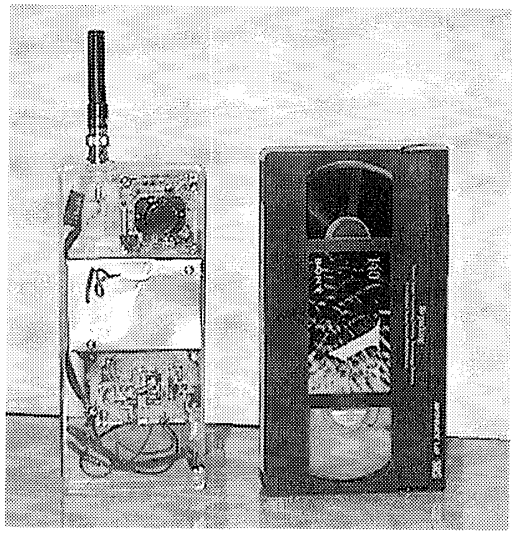


Figure 1 : Wireless Video Camera (WVC)

Although assumptions made about collaborating activity make it seem ideally

suited for many educational research and training settings. Then, there are questions concerning the use of monitoring way in collaboration that yet to be answered.

Therefore, the development study reported in this article investigate effects and applications of IMS through classroom tryouts.

2 Development of IMS

2.1 Design of IMS

Figure 2 shows the basic configuration of IMS.

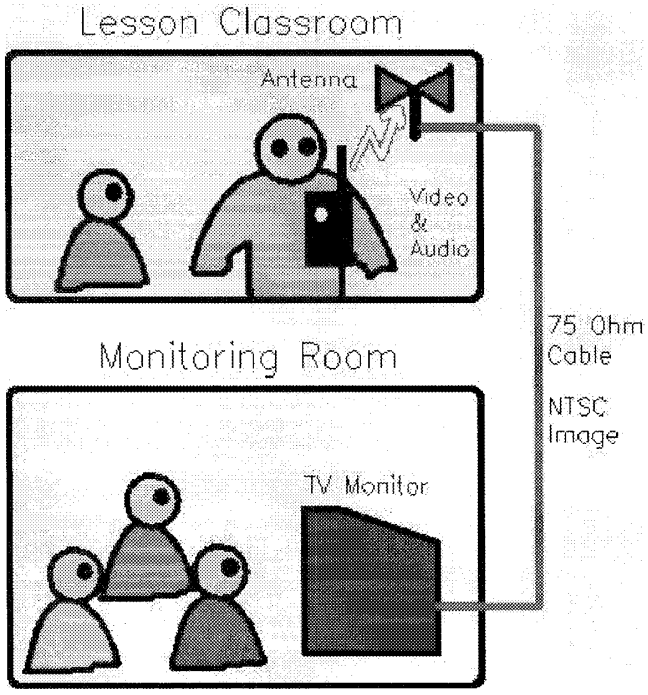


Figure 2 : Basic Configuration of IMS

The TV antenna must be set in a monitored classroom and it is connected to a local 75 Ohm unbalanced cable that is wired to a TV in monitoring room, then it is usual way to record the views of WVC to VCR. The classroom environment must include

Figure 3 : WVC in Pocket Position

unobtrusiveness, therefore it is important for features of design of WVC (see Figure 3). It has been usual ways for instructional researches to use ceiling-mounted camera or portable VCR camera in video monitoring system (Mackenzie, C. F. et al, 1995). However, the view point from ceiling was Third Person (Yoshida, 1995). Therefore, it was sometimes difficult for viewer to recognize what a teacher could see and also had the limitation of the compatibility between a teacher's recognition and the data from video recording protocol. The WVC can solve these problems technologically, and it has further benefits of collaborative instructional methods.

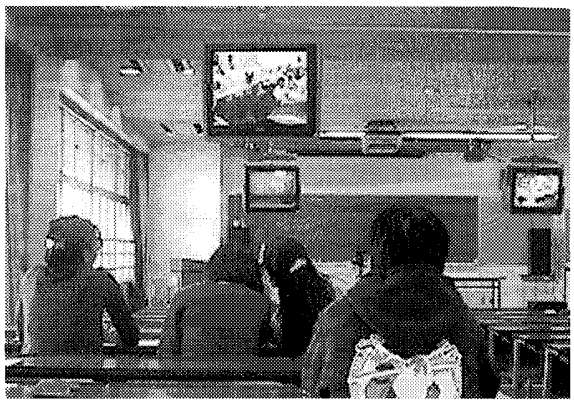


Figure 4 : Monitoring of Teacher's View

2.2 Development of WVC

The WVC (7×3×1 inch, showed Figure 1 above) was developed by Yoshida (Patentee). It is used in the pocket position of teacher's jacket. It was developed to shape to be minimize identification of the students and was built in a wide angle (1/3 inch CCD, 0. 05 Lux min., F. 2.0/f 3.6 mm, 360 lines, 96 degree) novel CCD with auto focus. Power consumption of WVC is MAX 300mA @12V, and it can be supplied 1 hour and 45 min. by Ni-MH rechargeable battery (4/3×4/3×2 inch) or 2 hours 30 min. by rechargeable sealed Pb battery (1×1×15/4 inch). The audio signal of built in electric condenser microphone is amplified over 40 dB by op-AMP and introduced to the transmitter circuit in WVC as well.

2.3 Minimum System Requirements

75 Ohm unbalanced cable, TV antenna, and TV tuner and monitor.

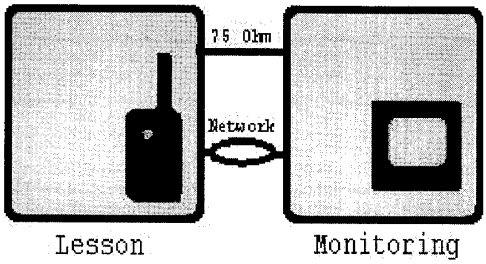
2.4 Expanding Peripherals

The signal of IMS can directly transmit to a video capture extension board built in a computer. This is the network application and the solution for presentations, video conferencing and portable collaboration activities. In this method, captured audio -video view can be transmitted to world wide networks, such as telephone, Internet or

satellite.

2.5 User Interaction with IMS

1) Monitoring

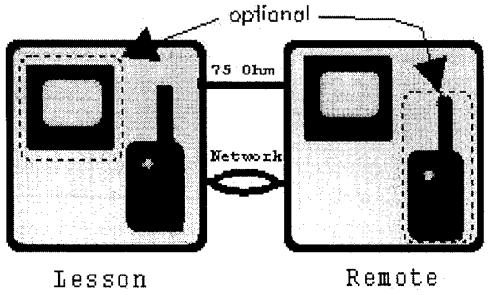


1a) Teacher Education : Monitoring can occur synchronously (i. e. real-time) and students in monitoring room learn teacher's decision.

1b) Peer Reviewing : IMS allows teachers to exchange their instructional skills and advice and discuss instructional methodologies with peers.

1c) Student Monitoring : Gathering data of student activities during a lesson through a WVC on a student.

2) Remote Class



2a) Teacher Training : A remote teacher, a combination with a live teacher through IMS which can transmit immediate indication, suggestion or feedback.

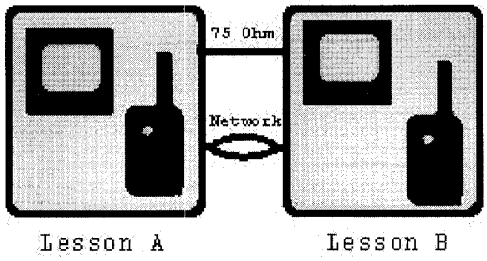
2b) Remote Activities : Remote expert, a person recognized as knowledgeable in the field of the lesson module who has volunteered or is being paid to cooperate with the class.

2c) Information Seeking : This is the alternative way of Team Teaching, by responding the request of students or instructor in charge, and sub-staff can provide information to the classroom.

3) Collaboration

IMS also can be used in alternative classroom design that go beyond the traditional lecture-style classrooms. That is called as flexible classroom. In this, not "instructor-based" classes, where the instructor's preparation is the major focal point, but "project-based" classes, where groups of students work together solving

problems or presentations while the instructor moves from group to group providing guidance and acting as a resource.

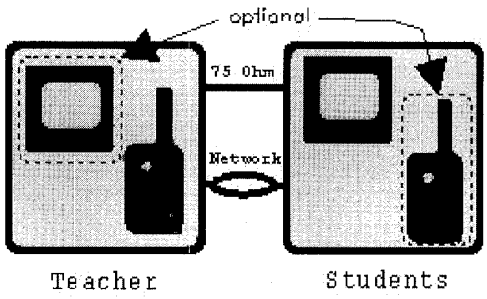


3a) Cooperative Learning : WVC with network can transmit the explanation view of procedural activities to distant place.

3b) Collaboration Activities : IMS has beneficial effects on communication between distant sites.

3c) Television Mission : WVC can easy to set up, if we compare with a conventional wired VCR.

4) Distance Education



4a) Demonstration : IMS allow to share the teacher's activities with teacher's view.

4b) Presentation : WVC can be used as a portable video camera or table camera.

3 Classroom Tryouts

The study of IMS in classroom was planned to be exploratory. The goal was to find out as much we could that would inform the design and applications of permanent IMS.

3.1 Class

Identical video acquisition configurations of IMS was examined in a lifelong course of Tokyo Cosmopolitan Government at a computer classroom of Sumida Technical Highschool.

Course Focuses : the basic computer training for novice including mouse operation, typing, graphics, homepage describing.

Instructors : A researcher, Major in Educational Technology or A teacher of upper

-secondary school.

Subjects in Monitored Classroom : 24 numbers of Aged citizen (Over 60 years old)

Subjects in Monitoring Sites : Members of Association of Tokyo Cosmopolitan Industrial Education Research of Upper Secondary School, night time course (8 subjects). And, university students : 15 subjects (major in Science Education), 11 subjects (major in Audio-visual Education).

3.2 Date and Session hour

7 tryout sessions were executed from June 1996 to October 1996, and each session was 2 hours long.

3.3 Settings

Basic setting was examined, that is IMS of one WVC. In addition to this, transceivers of small power were used for radio communication between subjects in a monitoring room and an instructor in charge simultaneously.

3.4 Method

For this study, we used 5 VCR (2 for classroom views, 1 for selected student activity, 1 for WVC view, and 1 for monitoring room view) for recording. After the each session, we analyzed WVC's function by Automatic Printing System of Time Sampled Video Pictures (APS) (Mio, 1996). APS can print out the multiple VCR pictures in a sheet (Figure 5).

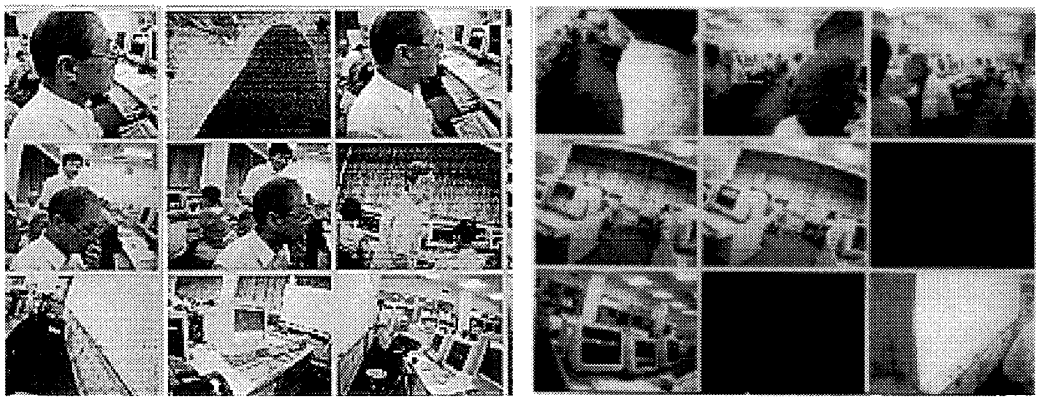


Figure 5 : Samples of APS's Sheet Pictures (left) and Pictures with Drop Frames (right).

Fujita showed that motion visual could be summarized with this time sampling methods (Itoh et al., 1995). Then, we referenced these findings and set the time sampling rate as 15 pictures/min.

And interviews and discussions regarding effects of IMS were executed after each session and summed up. Unlike more formal evaluations where improvement measures

are not implemented until the series of lessons are complete, we took the active research approach. That is, we regularly devised micro-improvement of IMS, implement, discussed the results, then repeated this cycle.

4 Results

4.1 System Function

The specifications of APS is quite strict that Component In/Out is 49dB MIN.,and Chroma AM : 52dB MIN., PM : 52dB MIN. Then, although the TV view was visible, drop frames were often occur in a sheet. However, APS is the excellent equipment for objective evaluation for WVC.

The following table shows the result of analysis.

Session No.	Instructional Styles	Antenna of WVC	Antenna at the edge of cable	Drop frame rate(%)
1	Lecture/Discussion	Wire	Rod	1.6%
2	Self Paced	Wire	Rod	0.82%
3	Self Paced/Group	Whip	Butterfly	4.5%
4	Lecture/Self Paced	Whip	Butterfly	2.8%
5	Group	Whip	Butterfly	2.3%
6	Group	Whip	Butterfly	4.5%
7	Group/Presentation	Whip	Butterfly	3.9%

4.2 Application

Through the series of tryouts, we could examine 1a, 1b and 2a showed in 2.5 above. We set the target instructional skills (three interactive skills) which to be observed in advance at 1a session (Figure 6).

Comments of College Students in Monitoring Room.

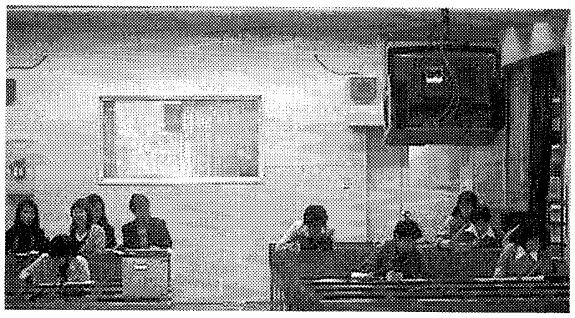


Figure 6 : Study on Instructional Skills with IMS

"I found [from the view of IMS] that there were many students whom a teacher could not see."

"IMS view is effective for a lesson in which teacher walking around."

"I mind the frame dropping which sometimes occurs."

"WVC's view [of a teacher] can not be applied to observation of a selected student activity."

"IMS enables to show the active expression of a student."

"I found the concrete data of a student [from IMS]."

Our conclusion: IMS transmits effective views for learning on teacher-student communication issues.

Concerning 1b, a live instructor communicated with monitoring room and often exchanged opinions (Figure 7).

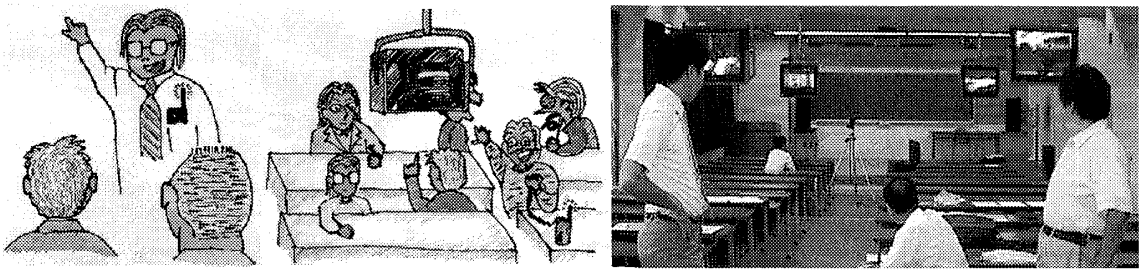


Figure 7 : Peer Reviewing in live setting with IMS.

Comments of Peer Teachers in Monitoring Room.

"IMS has the beneficial advantage for instructional study where participants can discuss about live events."

"I have never felt that teachers speak so fast in a classroom."

"I found that a teacher could not grasp the whole activities of students."

"IMS can allow to confirm the reason of indication that teacher tells to a students."

"Monitoring method is my fun, because we can discuss freely without minding a live instructor in charge."

"Peers were my personal timekeeper, supporter, database, guide teacher during the lesson, therefore I did not felt alone when I taught students. [Instructor]"

"Enable to observe instructional events objectively."

Our conclusion: Peer reviewing is not only available for a instructor but also teachers in monitoring room. IMS brings the frequent discussion between sites or within monitoring room.

Sometimes a teacher who did not have knowledge about homepage (teaching contents) was taking a part instead of instructor in charge (2a) (figure 8).

Comments of Remote Teachers in Monitoring Room.

"I could give suggestions to the live lesson without interrupting the classroom management of a live instructor."

"I could tell the reason for his unsuitable instruction at once, therefore he was able to correct and learn some instructional techniques rather than conventional way of

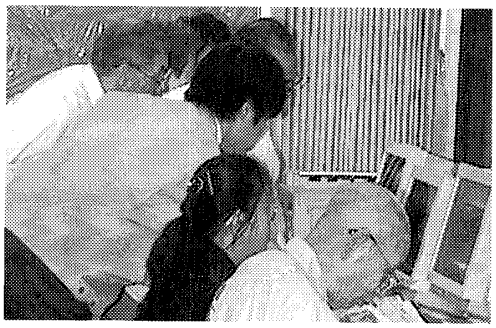


Figure 8 : An Instructor supported by Remote Teacher

suggestions which are offered after the lesson."

"I [Live Instructor] can pay attention about management classroom if I am in observed situation, and I do not need to pay so much attention about memorization of teaching contents."

Our conclusion : This novel method for teacher training on communication skills is effective than conventional ways, especially helpful suggestions and information to a live instructor support his concentration on demonstrating aimed communication skills.

5 Discussion

In this study, we could monitor the teacher's views of a distant classroom and use as effective materials for investigating instructional skills. However, as a result of Table 1, the function of WVC still must be devised. High frequency of WVC is over 500 MHz. To be sure, the result of fading soon can be anticipated on radio technology ground. Therefore, we must investigate the introduction of diversity antenna (multiple antennas) to receive WVC's wave clearly.

In most educational researches or educational learning with monitoring or observation of a lesson, the discussion must be executed after the lesson. While the all participants stay at the same place and same time during a lesson, recognition can not be shared.

It could be noted that circumstances brought by IMS have collaborative effects as well as monitoring effects. In this study, we reported only the results from the last investigation of various fundamental utilization. In near future, we have a plan to execute tryouts with multiple WVCs and network (Figure 9). In this settings, sites will communicate with providing live information each other. Domestic or specific data can give more impression to opposite site. Thus, IMS offer and can be conducted true inquiry-based cooperative research, where a teacher demonstrates solutions to a variety of classroom projects.

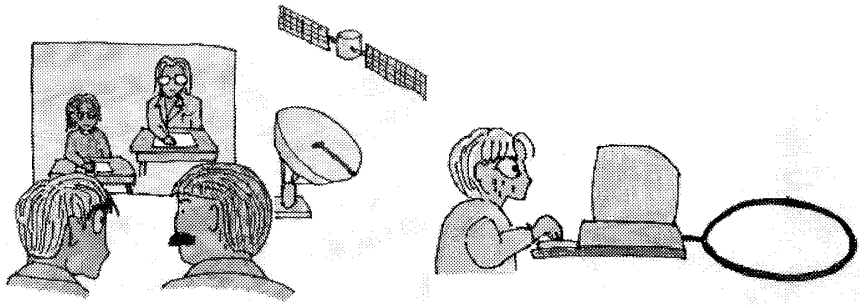


Figure 9 : Application of IMS to World Wide Network.

Acknowledgments

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教授モニタリングシステムの開発

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概要

著者らは，モニタリングと協力活動を遠隔地間で実現するためのコミュニケーション手段として教授モニタリングシステム（IMS）を開発した。このシステムは，無線ビデオカメラ（WVC）によりとらえた教授者の視点映像を遠隔地のモニター室に送信する機能を持つ。そして，このIMSの試行を生涯教育講座での教授・学習現場で行った。今回はIMSの応用が想定できる授業形態のうち，教師教育，仲間評価，現職教育の実践を実施し，知見資料を収集した。また，WVCの機器的機能を，自動タイムサンプリング画像印刷装置（APS）を活用して分析した。映像伝達率は，97.1%であった。

キーワード

クラスルーム・モニタリング，コラボレーション，教授スキル，教師の視点

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