5. EDUCATIONAL EFFECTIVENESS OF AN INTERACTIVE MULTIMEDIA COMMUNICATIONS ENVIRONMENT

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ABSTRACT

The goal of this study is to consider an effective environment to instruct and learn how to use interactive multimedia communications on the Internet. In this paper, we describe several experiments of interactive distance learning. In our experiments, we used a high-speed ATM network with Internet collaboration (video, audio and whiteboard combined), called as the Mbone (Multicast Backbone) tools and present the results of the questionnaires on distance learning to evaluate its effectiveness. We show good evaluation to our proposal environment to keep quality as ordinal lectures for learners and teachers from these results. Also, we get positive results for distance learning in the viewpoints of effective experience to learn on networks and familiarity with distance learning. This means that interactive distance learning is effective not only to solve time and geographic restrictions but also to learn/instruct multimedia communications. Finally, we discuss a new literacy education defined as Multimedia Communications Literacy (MCL) which is different from the existing computer or network literacy. The MCL must be required for teachers and learners to attend distance learning, and for everyone communicating on multimedia networks.

Keywords

Distance Learning, Video Conferencing, Multimedia, Internet

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1. Introduction

Increasing availability of higher-speed networks, two-way digital telecommunication facilities has introduced opportunities for interactive multimedia communications. Using the Internet has become a part of daily life for people in various fields in the world. From these changes, multimedia data such as images and voice can be transferred to several recipients all over the world by multicasting to transfer data across networks. The first such applications have come into widespread use on the Internet using the Mbone (Multicast Backbone), a virtual experiment network (Macedonia, 1994). Many applications such as videoconference or broadcasting are being done experimentally on this network. Using this kind of network, interactive multimedia communications will be necessary, especially for professionals in a cyber space as a basic way to communicate in the world. However, there is no good way to learn how to use interactive multimedia communications on the Internet. Distance learning is one of options given in the high-speed networks such as fibre-based terrestrial networks and satellite-based networks (Quemada, 1996) (Kondo, 1996). We focus on interactive distance learning as an environment to instruct and learn how to use multimedia communications on the Internet.

In this paper, we investigate an effective environment to instruct and learn and propose an environment of distance learning. We emphasise its educational effectiveness. First, we present the experimental environment using a high-speed ATM (Asynchronous Transfer Mode) network and the Internet collaboration (audio, video, and whiteboard combined) as the Mbone tools for distance learning. We show the results of the questionnaires to the learners on the effectiveness of distance learning (Maeda, 1997) and discuss their evaluation to our proposal environment to keep quality as ordinal lectures for learners and teachers. Through the experiments, we found an importance of a new literacy education which is different from the existing computer or network literacy. Then we discuss on a new literacy education defined as Multimedia Communications Literacy (MCL). Finally, we offer conclusions on the educational effectiveness of an interactive multimedia communications environment and describe the future problems.

2. Experiments for Interactive Distance Learning

2.1 Outline of Experiments

The purpose of our experiments is to investigate an effective environment to learn how to use multimedia communication tools on the Internet. Two sites, i.e. the teacher and the learners, in the experiments are connected by the ATM backbone providing total bandwidth of 67Mbps. We used the Internet collaboration tools (audio, video and whiteboard combined) for the six times of lectures described below and a remote camera control mechanism designed for this purpose. Figure 1

shows a typical snapshot window in a teacher site. The following are details of the tools.

- **Video: vic** (Video Conference) (McCanne, 1995).
- A user transfers his images through a camera to remote sites and receives all images from remote sites. Transfer speed, frame rate and compression format can be specified by each user.
- **Audio: vat** (Visual Audio Tool) (Jacobson, 1995).
- A user transfers his voice through a microphone to remote sites and receives voice from all remote sites. Transfer control is the same as a **vic**.
- **Presentation tool: wb** (White Board) (Jacobson, 1993).
- Presentation slides of course materials are displayed on a **wb** window. A user can operate for turning slide pages and additional writing and drawing in real-time on his window using optional buttons. These controls are transferred to remote sites. A **wb** provides a clear images (PostScript format images) of teacher materials rather than analog NTSC images captured by a camera.
- **Remote camera control:** a WWW browser with CGI.
- A teacher can see images of any location in a learners' room. He can change his view (right/left, up/down, and zoom) by clicking the buttons on a WWW (World Wide Web) browser window. An operator can choose two levels of moving or zooming degrees. This window is created as a Netscape browser by CGI (Common Gateway Interface). Using this function, a teacher can easily get reactions of learners, e.g., all learners or a specific learner.

A teacher operates these tools on his own workstation (in short, WS) by himself. All learners are in the same room at a remote site. Situations of learners' sites are different in six experiments as the following and the detail is in Table 1.

- Case 1, 2, 5, and 6:
- All learners can see clear images of a teacher and course materials on his own monitor (19 or 17 inch), but they cannot operate the collaboration tools and a teaching assistant operates instead of them.
- Case 3:
- The number of WSs for the collaboration tools is equal to the number of the learners. Different from other experiments, each learner can operate all tools on his own WS with its camera and microphone himself by multicasting.
- Case 4:
- Tool operation style is the same as the Case 1,2,5 and 6. The difference from Case 2 above is a big screen (over 200 inch). Learners see images on a shared big screen projected by a high resolution video projector (over 1000 TV lines and 2300 lumen).

2.2 Results and Discussions

The total number of learners is 246 through the six lectures. We prepared questionnaire sheets including 20 or 22 items for the learners. The major 15 questionnaire items and the evaluation results are shown in Figure 2. The vertical axis of Figure 2 means the normalized average of each item. The value 1 corresponds to good evaluation on a question item. Figures 2(a), 2(b) and 2(c) show the difference among three types of the learners, the difference between two display types and the difference on tool controllability, respectively. We also prepared questionnaire sheets including more than 20 items for the teachers.

2.2.1 Learners' Evaluation There is not a typical trend depending on the learners' type in Figure 2(a). The difference in items 4 and 5 might be caused by familiarity with computers and networks. Notable difference of display types is items 8, 9 and 10 as Figure 2(b). This means that an individual monitor is not always the favourite for learners. A more important factor is high-resolution. The difference of tool controllability is not so remarkable as Figure 2(c). According to the results, average scores of the learners' evaluation are higher than the median (0.5) except for the items 3 and 10. The learners' impression on the quality of images (both of a teacher and presentation pages) and voice is acceptable as an ordinal class. Moreover, distance learning itself was very attractive to them. The style of distance learning is effective for reinforcing attention and understanding of subjects on the network, computers and related things even though they did not directly operate the tools.

2.2.2 Teachers' Evaluation In all experiences, the teachers are familiar with computers and networks in their daily life, so operations of Mbone tools are not hard for them. Also, to prepare the on-line course materials used on **wb** is easy for them. However, operations of these tools and preparation of on-line course materials are not so easy for teachers in general. This is a remarkable problem to be solved in the future.

A feedback of learners' reaction in distance learning is important while lecturing as well as a discussion period. For this purpose, controlling a remote camera is required. The mechanism described above is simple and convenient, however an improvement of its user interface is expected.

Teachers' impression on the educational effectiveness of distance lecture is the same quality comparing with ordinal lectures. The distance lecture has advantages such as clearness of providing course materials by using high resolution display and presentation tools, even though quality of video images is relatively lower than TV. Concentration of participants' minds on the lecture seems to be same as or higher than ordinal lecture according to the results of the questionnaire to teachers and learners. To precisely evaluate the educational effectiveness of distance learning, we are planning to do comparative experiments, for example, lectures of the same topics for different members but similar situation by the ordinal lecture style.

3. Multimedia Communications Literacy

Through our experiments, we found a new literacy education for multimedia communications which is different from the existing ones. Computer literacy is used as the concept to learn how to use computers. Network literacy is to learn how to use the network services based on the Internet such as E-mail and WWW. Here we define Multimedia Communications Literacy (**MCL**) as a literacy to communicate interactively using various media such as video, audio and remote control devices simultaneously. The definition of **MCL** is natural in the next generation of computer and network literacy using high-speed networks and interactive multimedia communications. We need network literacy because of their effects all over the world and instantaneous propagation of information. The **MCL** is needed supposing that we can easily send and receive multimedia data by multicasting or broadcasting on the Internet in the world. There are several differences between the **MCL** and the existing network literacy. A bandwidth of connections must be recognized to use multimedia data such as images and audio data on networks. Interactive operations of collaborative multimedia tools should be acquired. The necessity of the **MCL** is to learn these additional points to the network literacy.

Here, we show the following points as teaching subjects of the **MCL**.

- How to operate multimedia communication tools,
- How to use network resources and information resource, and
- Ethics on multimedia networks.

To teach the first two subjects, we show the effectiveness of an environment for distance learning in the previous section. The **MCL** must be required for teachers and learners to attend distance learning, and for everyone communicating on multimedia networks including the Internet in the near future.

4. Conclusion

We emphasise the importance of multimedia communications on the Internet as the necessity for research work of the professionals in a cyber space. Some educational environment should be provided to be familiar with multimedia communications. Then we consider an effective environment to instruct/learn how to use multimedia communications through the experiments. From the experiments results, we show good evaluation to our proposal environment to keep quality as ordinal lectures for learners and teachers. Also we get positive results for distance learning in the viewpoints of effective experience to learn on networks and familiarity with distance learning. This means that interactive distance learning is effective not only to solve time and geographic restrictions but also to learn/instruct multimedia communications. Finally, we introduced a new literacy education called as the **MCL** to use multimedia communication methods on the Internet as daily tools. By learning the **MCL**, learners can consider effects of multimedia communication tools all over the world on the Internet. At the same time, they can learn convenience of

interactive multimedia communications. As a future task, we should consider a training method for teachers to teach the MCL.

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