The Future of Real Time Communications in Online Learning

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ABSTRACT

There is a clear trend in Web content from text-rich to media-rich and it is logical to expect Learning Management Systems (LMSs) of the future to not only increase media-rich content but also integrate media-rich Real Time Communications technologies (RTCs). This will enable a range of new activities to be undertaken and to take advantage of the LMSs organizational capabilities. Videoconference has been used in distance learning for many years. Video Chat and Access Grid are newer RTCs that have the potential for online learning. While these three technologies are similar, a comparison of them will provide direction for their future use.

INTRODUCTION

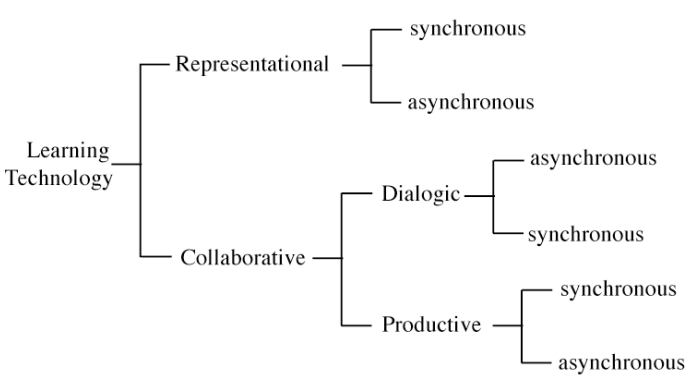
Distance education in the past was generally characterised by independent learning and little dialog between teacher and student. In the 1970s Moore introduced the theory of transactional distance (Moore and Kearsley 1995, p. 197). Transactional distance is measured by the degree of structure and the amount of dialog in a distance education course. Moore argues that communications between teachers and students in distance education "must be facilitated by print, electronic, mechanical or other devices" (Moore 1972, p, 76). RTCs are used to facilitate audio and video communications between teachers and students and include, videoconference, Access Grid, Web Conference and Video Chat.

TAXONOMY OF LEARNING TECHNOLOGIES

The Taxonomy of Learning Technologies (Caladine 2006) categorizes technologies as Representational or Collaborative (see figure 1). The term, Representational describes the communication in the one-way representation of material. Collaborative technologies facilitate two-way communications and are divided into the sub-categories of "Dialogic" or "Productive". Dialogic learning technologies are those that are confined to the support of dialog. Productive learning technologies combine two-way communications and the creation of products.

Videoconference is classified as Collaborative, Dialogic and synchronous. This contrasts to Access Grid when it is used as the host for collaboratively produced materials, in which case it is Collaborative, Productive and Synchronous.

Figure 1. The taxonomy of learning technologies (Caladine 2006)



VIDEOCONFERENCE

Videoconference can be thought of as two parallel, counter-directional closed circuit television systems. In the 1980s dedicated videoconference technology appeared on the market that could take advantage of the then new digital telecommunications networks such as ISDN (Integrated Services Digital Network). At this time videoconference use in distance education took a decided upturn. Today the trend is for videoconferences to use the Internet as the connecting network.

WEB CONFERENCE

Since Microsoft launched NetMeeting in the 1990s, other Web Conference tools have been developed and are now commercially available for use in higher education. Typically Web Conference tools are defined as combining synchronous video and/or audio communications with a shared computer application or presentation. Examples of Web Conference tools include: WebEx, Macromedia Breeze and Elluminate.

VIDEO CHAT

Instant Messaging applications were first limited to text interchanges and were generally free of charge. They evolved into voice applications and have become almost ubiquitous. After voice, video was a natural progression. Video Chat is defined as an application of computer technology that allows two-way audio and video communications. Thus Video Chat can be thought of as videoconference on a computer. Applications like Apple's iChat AV indicate that the future direction of Video Chat is a multipoint video communications tool with integrated file exchange and sharing, referred to here as "Enhanced Video Chat".

Video Chat is rather simple and inexpensive to set up, as all that is needed is a computer, a Web camera, a headset and an Internet connection of sufficient bandwidth. Most broadband connections are ample for this.

ACCESS GRID

Researchers have used the Access Grid as a communications and collaboration technology since its development in the mid 1990s. The Access Grid takes advantage of the Internet's multicast ability to send and receive multiple video and audio streams while keeping bandwidth to a minimum.

While Access Grid, Video Chat and videoconference are similar in that they all facilitate the two-way exchange of video and audio, Access Grid is differentiated by the multiple video streams sent and received from each endpoint or "node" and by a number of additional software modules. These modules include, shared presentation, shared browser, true application sharing and many more. Some commercial products that claim to offer application sharing in fact use the term to describe the transfer of files between participants. True application sharing allows participants to work on the same file at the same time. While room-based nodes on the Access Grid usually contain a wall of projected video images, as shown in Figure 2, smaller installations are possible. These are referred to as Personal Interfaces to the Grid or PIGs, and require similar technology to Video Chat.

COMPARING VIDEOCONFERENCE, ACCESS GRID, WEB CONFERENCE AND VIDEO CHAT

The role of videoconference in distance education is quite clear, as it has been

Figure 2. Multiple video streams of the access grid

used for the past fifteen to twenty years for communications between students and teachers.

The literature (Caladine 1999, Daunt 1997, Kobayashi et al 1997, Mitchell 1993) concurs that videoconference is best used as an interactive technology in teaching and learning and it is reasonable to extend this generalisation to Access Grid, Web Conference and Video Chat.

Access Grid and Video Chat are newer technologies and are yet to become established in teaching and learning. However, due to the low costs of Video Chat and

Table 1. Comparing technologies

	Video-conference	**Web Conference**	**Access Grid**	**Video Chat**	**Enhanced Video Chat**
Functions	Video and audio of participants	Audio (and video in some cases) of presenter - some have capacity for audio of participants	Video and audio of participants	Video and audio of participants	Video and audio of participants
	Presentation of computer images (eg PowerPoint) by participants	Presentation of computer images (eg PowerPoint) by one participant	Presentation of computer images (eg PowerPoint) by participants		Presentation of computer images (eg PowerPoint) by participants
			Control of computer images by any participant		
		Document or presentation transfer	True application sharing (eg spreadsheets, documents, movie viewers and others)		
		eWhiteboard sharing	eWhiteboard sharing		
			Computer desktop sharing		
Hardware costs	Endpoint - medium Bridge - high	Server - medium	Room based node – medium Personal Interface to the Access Grid - low	Low	Low
Software costs	Included - firmware	Licence – medium/high	Open source	free	free
Support costs	Technician - low	Technician – low (server support)	Technician - medium	none	none
Bandwidth required	Medium	Medium	Medium-high	Medium	Medium

the enhanced functionality of Access Grid, both technologies have the potential to play major roles. A comparison of the technologies on the criteria of functions and costs helps predict the future of these technologies.

While the technologies are all similar, they differ in the type and level of functions they facilitate. Videoconference and Video Chat are characterised by two-way video and audio. By comparison Web Conference in many cases cannot fully support two-way audio and video as well as deliver images from a participant's computer. Access Gird can be configured to do both and Video Chat is defined as two-way video and audio. Table 1 provides a comparison of the functionality of the technologies.

The equipment required for the technologies ranges from the simple to the complex, and hence the costs ranges from low to high. However, the initial cost of the technology is only one part of the costs criterion. Other elements of the technologies that incur costs are software, personnel to support the technology and the network traffic created.

Videoconference technology has improved in reliability and quality of picture and sound. Perhaps the change that has had the greatest impact on the way in which videoconference is used is the change from ISDN to the Internet. The Internet has reduced the need for designated videoconference studios; however, videoconference required bridging technology for the connection of multiple parties. Access Grid uses no local, bridging technology.

Given that videoconference endpoint and bridging technology is expensive, it is reasonable to predict that its use will contract to specialist areas such as, high definition uses for medical imaging, microscopy and motional analysis, and high level board-meeting-style, immersive videoconferences. As students are used to Video Chat technology and as there are great costs saving to be had it is reasonable to predict that the use of Video Chat in distance and online learning will grow and eventually displace videoconference. As enhanced Video Chat has the functionality of Web Conference software, without the expensive price tag it is reasonable to suggest that enhanced Video Chat will replace these.

Cost alone is enough of a driver to see institutions replace expensive videoconference endpoint equipment with the cheaper Video Chat. As well the enhancements of file sharing, and using Video Chat in conjunction with a shared application will see it develop into a Collaborative, Productive learning technology. This will allow students no matter where they are located to undertake a range of collaborative tasks such as, build resources, compile reports, debate issues, brainstorm ideas and more.

While Access Grid has been used for some years in research collaboration its potential for teaching and learning is only now becoming clear. Due to the multiple video streams sent and received, the Access Grid learning experience is visually much richer than videoconference and Video Chat. When Access Grid takes advantage of software modules that allow participating students to control the size of the received video windows and to control the cameras at other endpoints, the experience can be tailored to suit participants on a level beyond that of videoconference and Video Chat. Access Grid also has software modules that facilitate true sharing of files and applications and hence is described by the taxonomy mentioned earlier as Collaborative-Productive.

CONCLUSION

It is reasonable that future students will expect video and other examples of media-richness in their online learning experience. Learning Management Systems have played a significant role in learning for the past six to eight years and have been text-rich in both content and interactions. Their communications have generally been limited to text. Students could use the LMS email system, engage in a chat session or send a message to a forum. As Video Chat is fast displacing text as the preferred medium for Instant Messaging, it is expected that Video Chat will be integrated with Learning Management Systems. The integration will allow templates for their use and secondary applications that elevate simple video communications to rich learning events. For example a debating team could consist of students from different locations and the debate could be held in a virtual room on the LMS. If a shared eWhitboard, hosted within the LMS was combined with Video Chat a brainstorming session could be held between geographically dispersed students and other examples abound. Further it is not inconceivable that the Access Grid could be integrated with the LMS. Such an integration would allow the flexibility to have a small group at a regional Access Centre and larger group at a room-based node on campus and individuals at home on a personal interface.

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