AUDIOGRAPHICS USED IN DISTANCE LEARNING

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This paper presents an introduction to audiographics technology, its advantages and disadvantages and a short summary of responses to an ongoing, informal inquiry into the present uses of audiographics.

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INTRODUCTION DISTANCE EDUCATION

Distance Education's span is both broad and deep: teaching accounting and anatomy to veterinary medicine; teaching in rural schools for staff development, and to increase student retention; teaching in countries from Australia to the United Kingdom. Educators and trainers today are faced with the challenge of supplying quality education to a more and more diverse and geographically dispersed group of people. One of the primary components of effective learning is for students to construct and reconstruct meaning; a process which occurs when students interact with each other, with curriculum content and with teachers (Bates, 1990; Moore, 1989). Technologies are being increasingly used to facilitate these interactions and convergence of telecommunications, computer, video and audio technologies is emerging as part of the interactive solutions to education at a distance and face-to-face (Technology Links, 1989). Different technologies support different kinds of interactions, and hence different learning for different kinds of learners. Selecting the right technologies for the task and the learning group is an issue facing educators.

Using technology in distance education

Educators and trainers, especially those involved in distance learning, have long been searching for the Holy Grail of instruction: to be able to teach and have students learn anything, any time, any where (Berge & Collins, in press). If used appropriately, audiographics technology can help in this quest. Bates (1990) notes that conventional distance learning students do most of their studying alone, interacting with textbooks and other learning media. There needs to be both high quality, prepared permanent material and a two-way communication among students and tutors. One powerful element of audiographics is the capability for interaction and team work that becomes possible among students who have so far not had that opportunity. There has been a rapid expansion in the types of delivery technologies available to the educator involved in distance learning (Technology Links, 1989). Correspondence and broadcast media have traditionally been the mainstay of distance education. CD-ROM, teleconferencing, video cassettes, electronic publishing and satellite and cable TV are emerging as viable, cost-effective options. The generic definitions of teleconferencing include any electronically mediated communication between two or more persons including transmission of audio, video and digital information produced by a computer. The technology being explored in this paper combines audioconferencing simultaneously with computer conferencing.

Audioconferencing systems

Audioconferencing options, in general, include dedicated conference networks which permanently wire preselected locations together, dial-up networks

that use the public switched telephone network and in which the bridge operator calls and connects all participants, 'Meet Me' conferencing in which each participant calls the conferencing centre from any convenient location, and Direct Dial Conferencing System that makes it possible for one caller to set up a telephone conference with a limited number of additional participants by using a touch tone phone.

AUDIOGRAPHICS

Over several decades, educational institutions worldwide have begun to incorporate audiographic conferencing technology into their distance education programs (Gilcher & Johnstone, 1988). Audiographic teleconferencing, which involves simultaneous transmission of voice, data, and graphic information over a pair of ordinary telephone lines, complements audio communication with visual information. It can potentially serve distant students at a reasonable cost and sometimes without requiring instructors to radically modify their classroom behavior. The technology does not usually require new institutional support systems. The instructor can present information both orally and visually in a real-time communication environment and, at the same time, allow full interaction among participants (Lowe, 1993). Students can also create, use, and discuss visual materials.

Defining 'audiographics'

Audiographics merges computer graphics, telephone communications systems, and instructional design into a cost effective method of delivering distance education classes (Fredrickson, 1990). A typical audiographics system requires a location with access to two telephone lines (Tiffen, 1992). Hardware includes a computer with a VGA monitor, a substantial amount of RAM, a capacious hard drive, a mouse or a light pen and tablet and audiographics software. Audio can be carried on dedicated audioconferencing equipment, a speaker phone, or, most recently, on an internal computer card that supports both microphone and speaker. Optional equipment can include a slow scan video camera and a television monitor, a (color) scanner, printer, copy machine, facsimile machine, audio cassette player and/or a telewriter. For large audiences the images on the computer screen can be projected onto a large screen via a projection tablet and an overhead projector.

Audiographic technology then permits simultaneous transmission of voice communication and graphic images across voice-grade telephone lines. Visual images, (e.g. illustrations, diagrams, maps, computer generated graphics), can be created in various desktop publishing and presentation software packages, digitized and sent to and/or stored at remote instructional sites to be called up from the local computer's hard drive as required. The instructor is linked via telephone lines, an audio-bridge, and modem with instructors or teaching assistants and students at remote locations. Graphics and still video images of in-class activities can be displayed at all sites on computer or video monitors so that real-time graphic production on some type of electronic blackboard or writing tablet is used. Voice (audio) interaction occurs through speaker phones, or dedicated audioconferencing systems. This connection allows two-way or multi-point interaction among students and instructor/s. Users have the capability to speak with one another, share text, video and graphics images, and annotate images that are displayed on their own computer monitors using the light pen or mouse and tablet.

The audiographics system allows students to scan and transmit their work to the instructor for review, feedback and evaluation. Whether for large group presentations, small group conferences, or individual reporting and feedback, graphics can be prepared ahead of time, stored and used, or created on screen during class time (Knapczyk, 1990). Additionally, multiple user sites can be linked together as if in a conference call. While many practitioners have commented that occasional face-to-face meetings are useful, especially in the beginning of a course, we assume in the following description that geographic distance precludes this. The following commentary also assumes audiographics is an ongoing delivery method for course work over the semester or year.

Benefits of audiographics

The greater access to educational opportunities afforded by audiographics is significant from the viewpoint of business or academic institutions, and their instructors and students. While we list several advantages under each category below, clearly there are many of these that benefit more than one of these stakeholders.

Institutional considerations

From the business training, or other institutional vantage point, the benefits of audiographics includes the relatively inexpensive delivery of instruction and information to remote sites or locations off site. It is the least expensive audio/video option when considering start-up and operating costs (Fredrickson, 1990), and requires the least software, training, and maintenance among technologies permitting live exchange with graphic and still-frame video images. Audiographics, even when considering the cost of long-distance telephone calls, is more cost-effective for instruction or other meetings at a distance than most forms of interactive video conferencing. Using audiographics saves the travel expenses involved in bringing many persons to one place at one time or for instructors to commute, or for hiring teachers to teach at each site. It can be used with home-bound students, prison inmates, and 'special case' non-attending students or trainees in both rural and urban settings. Small classes at different locations can be combined to reduce instructor overhead (or to cost-share salaries) and mitigate travel requirements, while providing instruction that might not otherwise be available in remote locations.

Being easy to install, maintain and learn to use are very significant aspects of audiographic technology. The equipment is portable and easily moved to different locations, although this has the potential of introducing technical problems as equipment is assembled, and reassembled. It gives a program director the ability to program a wide variety of classes from college credit courses to public service programs, and flexibility in using various formats and instructional methods for those and other type meetings. Course materials can be up-dated and changed with relative ease, and new courses can be quickly produced.

Instructors' perspectives

Fredrickson (1990) regards audiographics as the most cost-effective, efficient, and motivation-enhancing distance education system

currently available. Along with allowing a high degree of organization of the material to be learned, audiographics is flexible in permitting a wider variety of presentation formats than distance education delivery methods have allowed in the past (Knapczyk, 1992). The technologies that are used, (i.e. the telephone and microcomputer), are familiar and increasingly accessible to both faculty and students.

While much more initial preparation time is required of instructors, graphic materials that are prepared for one class can be reused in subsequent classes and revision of materials is relatively easy. Images can be scanned and stored on hard or floppy disks; and instructors at both local or remote sites can control equipment functions. Perhaps most importantly from an instructor's perspective, is the high degree of teacher—student and student—student interaction possible through audiographics systems.

Knapczyk (1990) points out that, during class, users at any location can 'give responses verbally or annotate images by means of the computer keyboard, graphics tablet, or mouse' (p. 6). This highly interactive nature of audiographics encourages students to be prepared for class and to pay more attention to the screen and person speaking than to the chalkboard in face-to-face instruction. Fredrickson (1990) notes that students are unwilling to be seen as 'unprepared' for class, and, with the high degree of interaction between teacher and student, it quickly becomes obvious if students have not read an assignment or completed their assigned homework. Yet the same content can be presented in several media, which may address the needs of several different learning styles. When working in a cross cultural situation where students may be using English as a second or third language, Chute and Shatzer (1989) note that 'visuals provide content organization and redundancy in the message essential for correct interpretation of the instructor's message,' but cautions that the visuals need to be culturally appropriate in terms of color and image selection.

Gunawardena (1992) determined, however, among an instructor's most challenging tasks may be coordinating activities at distance sites, and facilitating and supporting group work at a distance. She also elaborated on the changes needed in an instructor's approach to instruction from that of dispenser of information from the front of a classroom to a 'facilitator guiding and supporting the learning process' (p. 70) and remarks that role consumes more time and energy that teaching a traditional class.

Stacey (1993) emphasizes the need for rigorous advanced preparation of teaching materials and notes that audiographics 'is a very accountable medium, unforgiving if materials aren't at hand or well planned'. We can not emphasize too strongly that images, created as slides, need to be designed and prepared before class starts whenever possible (Swift, 1993). While the system allows the flexibility to annotate and use the electronic blackboard during class, it is time consuming and should not be relied upon for graphics that could be prepared prior to class by instructor or students.

Learners' perspective

The learner is concerned with many things as he/she learns-learning in a audiographics environment is no exception. Successful learning via audiographics hinges on such things as the student's own characteristics, course design/development, the instructor's presentation skills, media benefits and limitations, and on-site and off-site coordination activities.

From the learner's perspective, the benefits of audiographics include the opportunity to communicate in real time with learners at other sites, an increased sense of 'presence' in a learning situation, variety in learning materials, formats and methods, and user-familiarity with the individual components (telephone, computer, television). When learning a second or third language, audiographics provides a venue for authentic practice with others outside their own classroom. There is some research evidence to support that motivational levels, attitude levels, and the quality of the learning experience have all been positively affected by audiographics (Fredrickson, 1990). All these aspects usually require students to take responsibility for their learning more than they are use to in more teacher—centered classes.

Limitations of audiographics

While the individual components may be familiar and easy to operate, one of the weaknesses of audiographics is the steep learning curve inherent in learning to integrate multiple pieces of equipment, and the unpredictability of the connections between sites. Audiographic setups also require two available telephone lines within easy connection range of the equipment. (There may be long distance phone line costs, too.) Some students find the lack of moving images disconcerting and computer screens are not easily seen by large groups of people. And there are still many persons, both students and instructors, whose anxiety level rises precipitously when they have to deal with any single form of technology, let alone the suite involved in audiographics. Additionally, most of the software used in audiographics often does not allow different platforms to be connected together in the same session.

Additionally, Chute and Shatzer, (1989) note that, while bringing experts and learners together from anywhere in the world has advantages, a successful audiographics learning experience necessitates an awareness of cultural differences that affect instructional design strategies. Even though audiographics technology uses familiar equipment, high levels of accessible technical support are still required to deliver the course, especially when the equipment and instructor are new. In a distance education environment, staff requirements may also be affected by acknowledging that the responsibilities of instruction must be divided between the delivery and receiving sites. Since the facilitator at the receiving site performs some of the functions of a teacher, many states now insist that certified instructional staff fill such positions.

Social context cues are limited in audiographics and the cues available for predicting and assessing others' reactions are different from those available in face-to-face interactions (Burge & Roberts 1993). Not being able to see students' 'body language' was a source of initial concern to pre-service teachers functioning as audiographics instructors (Stacey, 1993). Burge and Roberts (1993) suggest that rules for interjection and conversational turn-taking be set up and that 'talkers' not be allowed to dominate sessions.

HOW AUDIOGRAPHICS IS BEING USED

To get some idea of how audiographics was actually being used, we sent a note to the Interpersonal Computing and Technology List (`ipct-l@guvm.georgetown.edu` — see endnote). This is a scholarly discussion group with a membership of approximately 1200 persons in more than 40 different countries. The note asked for those who were using

New mail on node 'melia' from "in%'edu01lundque@melia.qut.edu.au'" audiographics to respond, if they were willing to answer some questions. To those who responded, we sent the following questions:

1 Asked who they were and what their responsibilities are.
2 What are the hardware/software components of your system?
3 How long have you used audiographics?
4 How many sites are linked by audiographics?
5 Who is your intended audience?
6 What training/support is provided to instructors?
7 What is your most successful application?
8 What is your least successful application?
9 Advice for new users.

This was not a formal 'research' study but an attempt to get a quick snapshot of persons using audiographics now. It was also hoped that we could build a resource list of persons who might be willing to advise a group of distance education graduate students, who would be designing audiographics instruction the following semester. Several respondents generously agreed to serve as 'subject matter experts' for this graduate student audiographics group, and one instructor in Australia generously offered the loan of professionally produced videotapes showing the use of audiographics in teaching second languages in primary schools (Stacey, 1993).

Response summary

1 We received responses from Australia, Finland, both coasts of Canada and the United States. Instructional designers, classroom teachers, and teacher educators responded, as did the executive director of TeleEducation for a Canadian province (who included a paper produced for his provincial government) and the director of research and evaluation at a distance education center at an Australian University.
2 Both DOS-based and Macintosh machines were being used, typically with high-end processors, large amounts of RAM and capacious hard drives. A full range of optional equipment was used, as described above, although not all sites used all pieces of supplementary equipment. It should be noted that most audioconferencing software does not permit more than one computer platform within the system (e.g. Macintosh and DOS). Some software/communications systems do work over the Internet using TCP/IP protocol, however.
3 The twelve respondents had used audiographics systems from one to almost five years.
4 Training in the use of audiographics equipment ranges from a two week training period for instructors to instructors having to seek out their own sources of information and learn by trial and error. Several respondents mentioned the importance of site coordinators, but that their training was done informally.
5 Three to six sites appears to be the most frequent number of sites connected in any one session, while as many as 150 sites could potentially be accessed in a single Finnish network. One respondent remarked that audiographics typically seems to be used for interactive small group work at the primary and secondary levels, and as a broadcast medium to larger groups in higher education.
6 All the applications reported involved delivering instruction to students, although one respondent also used audiographics with up to four colleagues at a time when planning instruction.
7 The range of applications spans veterinary medicine to second language literacy to engineering to teacher training. The common features seem to include material that can be structured ahead of time and delivered with a high visual content, and that invite small and large group interactions. The need for a mix of presentation methods was evident in the provision of course handbooks for both students and teachers and student study guides. Apparently audiographics, like most forms of distance education technology, finds its best use as part of an integrated delivery system.
8 The audiographics application most often mentioned as a failure is the delivery of straight lecture material by the instructor, allowing little or no interaction among the participants. Technical problems are also mentioned with both equipment and connections, as is the necessity for high levels of available technical support.
9 The advice most frequently offered to new users was that the instructor and instructional materials be meticulously designed and prepared ahead of time to minimize delays during transmission; that substitute activities to be completed in case of equipment/transmission failure be available at all sites and that the learners be actively engaged in some form of collaborative learning.

CONCLUSIONS

Through effective planning, design, and delivery, training and educational courses can be greatly enhanced through the use of technology. Teleconferencing, in all its forms, bridges the geographical distances between learners, integrating telecommunications to effectively and efficiently increase human performance. Audiographics systems include audio, video, and computer technology, that can be combined in various permutations. It is important for educators and researchers to identify factors that should be considered in media selection, including access, costs, student control, teacher control, organization, teacher time, and teaching/learning objectives before settling on an appropriate mix of technologies. It also is important to recognize that all formats for delivering instruction have their strengths and weaknesses. It is rare that one delivery method meets all instructional needs. Therefore, a combination of presentation formats, including providing students with print materials, are usually needed to minimize costs and maximize learning. Audiographics is no exception.

ENDNOTE

Since the time we posted the survey, we have learned of another list: `audiographics-l@cln.etc.bc.ca`. The stated purpose of Audiographics-L is to provide a forum for the discussion of issues related to use of audiographics in the context of distance education. It supports the exchange of fact and opinion to do with matters technical, methodological, developmental and financial. The list is also intended to host a dialogue on problems, solutions, prospects and trends associated with such concerns as infrastructure, copyright, instructional resources and finances. We would recommend that anyone interested in audiographics might subscribe to this list by sending to `listserv@cln.etc.bc.ca` the command 'subscribe audiographics-l yourfirstname yourlastname'.

REFERENCES

Bates, A. W. (1990). *Interactivity as a criterion for media selection in distance education.'* Paper presented at the Annual Conference of The Asian Association of Open Universities, Universitats Terbuka, 15-26 September. ERIC document ED 329 245.

Berge, Z. & Collins, M. (Eds.) (in press). *Computer-Mediated Communication and the Online Classroom: Overview and Perspectives.* Volume 1. Cresskill, NJ: Hampton Press.

Burge, E. & Roberts, J. (1993). *Classrooms with a difference: A practical guide to the use of conferencing technologies.* Toronto: University of Toronto Press.

Chute, A. & Shatzer, L. (1989). Designing for International Teletraining. Paper published in *International Teleconference Association 1989 Yearbook,* May.

Fredrickson, S. (1990). *Audiographics for Distance Education: An Alternative Technology.* Paper presented at the Annual Conference of the Alaska Association for Computers in Education (March 1990).

Gilcher, K. & Johnstone, S. (1988). *A Critical Review of the Use of Audiographic Conferencing Systems by Selected Educational Institutions.* International University Consortium, University of Maryland University College, University Blvd. at Adelphi Road, College Park MD 20742

Gunawardena, C. N. (1992). Changing Faculty Roles for Audiographics and Online Teaching. *The American Journal of Distance Education,* 6(3), pp. 58–71

Knapczyk, D. (1990). *Field Based Preparation of Practicing Teachers Using Distance Education.* Paper presented at the Annual Joint Conference of the National Rural and Small Schools Consortium and American Council on Rural Special Education, 4th. Tucson, AZ, March 18-23.

Knapczyk, D., Brush, T., Champion, M. A., Hubbard, L., & Rodes, P. (1992). Going the distance for staff development. *Educational Horizons.* Winter. 88–91.

Lowe, K. (1993). *Audiographics for Adult Literacy.* Part III Report. Department of Employment Vocational Education and Training, Adult Literacy Services Bureau Western Australia.

Moore, M. G. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education,* 3(2), pp. 1–6.

Parker, L. (1983). Teleconferencing in Education. *ERIC Digest.* ERIC Clearinghouse on Information Resources, 030 Huntington Hall, Syracuse University, Syracuse, NY 13210.

Stacey, E. & Turner, L. (1993). *Telematics teaching—a practicum of the future?* Paper presented at the ASPESA Conference, Adelaide, Australia, July 21–23.

Stacey, E. (1993). *Telematics in teacher education.* (Video recording). Melborne: Educational Media Services, Deakin University.

Swift, M. (1993). *Tele-Learning: A Practical Guide.* The Open Polytechnic of New Zealand.

Technology Links: Choices for Distance Learning Systems. (1989) *Linking for Learning.* Washington D.C., Office of Technology Assessment.

Tiffin, J., Rajasingham, L., and Pennings, A. (1992). *The Telelearning Handbook.* Wellington, New Zealand. Words Worth, Ltd. ◆