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ABSTRACT

To help teachers in urban schools implement technology in their science instruction, two science educators analyzed a number of models for technology training. This paper explores answers to the question of how to design technology sessions so that they are highly valuable professional development experiences for teachers. The models for these training opportunities include sessions for single-skill-level groups, heterogeneous groups, and individual conferencing. The major advantages of each model are presented along with explanations of the difficulties encountered. The analysis of these different models, and the discussion of the process through which the technology sessions were developed and refined, demonstrate ways in which other science educators can support the efforts of science teachers to use computer technology with their students. (Contains 14 references, 2 technology surveys, and a World Wide Web manual.) (Author/DDR)

A Comparison of the Efficacy of Different Models of Technology Instruction for Inservice Teachers

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Abstract:

As students in urban school systems are less likely to have access to computers in their homes than their suburban counterparts, the provision of adequate technology instruction in school has become a serious concern for urban educators. To help teachers in urban schools implement technology in their science instruction, two science educators analyzed a number of models for technology training. Originally started as a component of the National Science Foundation's Urban Systemic Initiative, these technology sessions spawned a new focus of interest: how should technology sessions be designed to be highly valuable professional development experiences for teachers? The models for these training opportunities included sessions for single-skill-level groups, heterogeneous groups, and individual conferencing. In every type of technology training it was important to tailor sessions to meet the needs of the teachers and to ensure that the instruction helped them move beyond their existing skill level. The major advantages of each model will be presented, with explanations of specific difficulties encountered. The analysis of these different models, and the discussion of the process through which the technology sessions were developed and refined, will demonstrate ways other science educators can support the efforts of science teachers to use computer technology with their students.

Rationale:

While the use of computers has become an integral aspect of modern society, there is reason to be concerned that students in large urban school districts are not receiving the exposure to, and instruction in, technology that will prepare them for the future. While we might expect that teachers would use technology in their instruction, just as they would teach higher-order thinking skills and writing across the curriculum (Barksdale, 1996), learning how to do this requires time, effort, and money. The national interest in improving public education opportunities (as evidenced by the movements towards national science education standards and national teaching accreditation standards, for example) adds additional urgency to the situation. Inherent in the new standards is the expectation that teachers will be increasingly well versed in educational technology, including "the use of computers and other technologies for instruction and student evaluation" (Wise, 1996).

Most inservice teachers over the age of thirty received their training before the explosion in the technology field, and before state and national accreditation boards mandated technology training for pre-service teachers. Consequently there are large numbers of inservice teachers who need to learn how to use the technologies to improve their practice. A recent study of what motivates teachers to learn to use advanced telecommunications found that fifty-one percent (51%) of public school teachers did so on their own initiative, while an additional thirty-one percent (31%) did so because of some incentive offered to them (NCES, 1997). Many of the teachers who participated in the technology professional development opportunities described in this paper would fall into one of these two categories.

We identified a number of factors that exacerbate the situation further in urban schools. Initially, there are few successful models for integrating technology and education to follow (Woodrow, 1996). There is also an anachronistic culture in schools with values and organizational systems that resist today's realities (Goldberg, 1995). Furthermore, many urban school facilities are older buildings, which require extensive and expensive retrofitting and rewiring to meet current codes and to install new technology. A 1995 study by the U.S. General Accounting Office found that almost half of our nation's schools have inadequate wiring for computers and communications (NEA Today, 1998). The technology itself is expensive, and even when installed there is no guarantee that classroom teachers will know how to use it effectively to improve their practice.

Therefore one of the most critical considerations in the delivery of professional development in technology should be the teachers themselves, centering around their lack of personal experience with computers, the inadequate equipment previously available to them, and the chronically insufficient time for professional development in the school schedule. This paper presents the work in progress of two science educators working with the delivery of technology education to inservice teachers in large urban school systems. In order to minimize the impact of adverse conditions, and to maximize the benefits for the participating teachers, we explored and compared a variety of strategies for providing technology instruction to inservice teachers in elementary, middle, and secondary urban schools.

Research Design:

This work began as part of an Urban Systemic Initiative (USI) grant from the National Science Foundation (NSF) to a large urban public school system. The NSF grant has allowed teachers in the district some options rarely seen in teaching: opportunities for sustained professional development in their own buildings, and for learning more about effective teaching of science and mathematics using technology. The effort to improve student achievement in mathematics, science, and technology has been pursued vigorously through professional development experiences for teachers from elementary, middle, and secondary schools, in part through the efforts of the Teacher Support Team (TST).

The carefully selected members of the Teachers Support Team are school teachers in the urban district under study who have been placed on special assignment for the duration of the grant. They are assigned for an intensive period of up to two months to elementary and middle school buildings in teams of two. In each pair one TST has a strength in science teaching, while the other has a strength in mathematics teaching. All members of the TST also experience ongoing professional development themselves, for example, in peer coaching, mentoring, efficacy, district adopted science kits and mathematics materials, and current technology. School staffs which applied and were selected to be in the USI program in the first three years of the grant from NSF have written technology plans, ordered and installed new computer technology, and developed building implementation plans to establish goals, identify needs, and plan professional development for themselves. The ultimate goal of the USI and everyone in the district has been improved student achievement in the areas of mathematics and science, from kindergarten through grade twelve (K – 12).

The co-authors of this paper were the two science educators most directly involved with planning and implementing some technology related professional development experiences for building staff during 1995 – 1997. One has been a member of the Teacher Support Team since the first year of the grant; the other a doctoral student in Mathematics, Science, and Technology Education. Together they analyzed the efforts, with particular emphasis on how the insights gained might help other science educators support the efforts of science teachers elsewhere to use computer technology with their students. The inservice opportunities described below were in large part designed to help teachers acquire sufficient expertise with computer technologies to incorporate into their teaching the wealth of material, strategies, lessons, information, and educational initiatives available through the Internet, and the World Wide Web in particular. Although the considerable contributions and benefits of other technologies (for example, high resolution televisions, liquid crystal display (LCD) panels, laser disc players, videomicroscopy cameras, calculator based laboratories and probeware, graphing calculators, digital cameras, videoconferencing, hand-held global positioning units, etc.) to science education must be acknowledged, these efforts were limited to the needs teachers expressed for computer-based technology training. Several different models were developed. For each the practical considerations of the various settings in which technology instruction was provided forced the implementation of a variety of instructional strategies, and required both flexibility and creativity. Each model is summarized in the table, and addressed more completely in the text following:

Model Types	# of Teachers	Format	Technology
Concurrent Ability-Related	120 teachers; put in smaller groups of ~ 20; 2 – 4 instructors	small groups; similar skill levels & abilities; 1 per computer	Internet &World Wide Web resources
Single Session; Mixed Ability	20 per session, 2 per computer 2 instructors	menu-driven; self-paced; more familiar lab	laptop computers; Internet &World Wide Web resources
Building Level Teacher Teams	4 teachers/bldg. 4 CPS middle schools	summer training one wk + follow up during year	Internet; distance learning; supported by additional grant funding
Individualized On-Site	often 2 – 4, small or larger groups learning to use building technology	on site, held during planning periods, or at after school inservices w/ compensation	word processing; spreadsheets; grading programs; Internet & WWW; other technology
District-Based Technology Courses	varies, small groups of 10-20	held at a well-equipped computer lab in district, low or no cost; after school or summer; self-paced using manual	word processing; CD ROM software review; spreadsheets; HyperStudio and other software training; Internet & WWW digital camera & other

The **Concurrent Ability-Related** sessions for a large group (120) were taught as part of a ten week university professional development course on the integration of mathematics and science instruction. Teachers enrolled in the course (all of whom were from current USI schools) were asked to complete a one-page questionnaire (Appendix A) concerning their prior computer experience, and were divided into five homogeneous instructional groups of twenty to thirty (20 – 30) teachers. Each small group was led by a member of the Teacher Support Team, with the volunteer support of one or two education graduate students at the university. The small group sessions were designed specifically for each section (based upon the information gleaned from the surveys) with the intent of advancing the teachers' levels of expertise, and were in computer labs on the university campus. To ease parking concerns, teachers met at another location and rode yellow school buses to and from the five computer labs on the university campus.

Despite the our best attempts to group teachers in groups according to their needs, many teachers expressed frustration with the technology session they attended. The university computer labs themselves caused a large part of the problem. To connect to the Internet each teacher had to have a university log-in; temporary accounts were provided for those who did not have a university Internet account of their own. However, for many teachers, especially those for whom touching a computer keyboard was a new experience, the numerous and exacting key strokes which were necessary to access these temporary accounts were overwhelming. Confounding the issue, several of the temporary accounts did not work correctly. Furthermore, in one of the five labs several computers crashed simultaneously, overwhelming the teachers and interrupting the instructors. Later we learned that these were common problems; usually the lab proctor is able to help students who experience difficulty. It was our bad luck that so many problems combined together on one night, and in one lab, and to beginners. Fortunately we were able to learn from the experience, and make improvements before the next sessions were scheduled.

We were able to gain particular insights to what the teachers' problems had been because of the nature of the evaluation form we used. This form contained four open ended questions widely spaced down the page:

- I came expecting ...
- I got ...
- I value ...
- I want next ...

This particular evaluation strategy works in almost any situation and tends to elicit very authentic information from participants. From the small group sessions we held that night, some of the teachers left more frustrated than when they arrived; we knew we had to make some changes in our design before we tried again. One teacher commented: "Although I was put in a group that was toooo advanced, I did what I could, got to a computer, and learned!" Another said "Despite my frustration with the computers, I valued my experiences with the technology session! What I learned will help me in my science class tomorrow!" Fortunately the teachers who had been the most frustrated were able to communicate with the technology instructors later in the course, to ask further questions, and to receive additional support. Most did feel by the end of the ten week course that their expertise in computer technology had advanced, even though the course included only the one night of hands-on computer use.

Single Sessions for Mixed-Ability Groups were taught as part of our next university professional development course created specifically for mathematics and science teachers in the urban district. The class met every week for ten weeks at a centrally located district high school. This particular high school featured an IBM computer lab with twelve computers connected to the Internet via a T1 cable, and was selected for the course on this basis. The technology sessions experienced no difficulty connecting to the Internet or to the World

Wide Web; every evening went as planned. On consecutive weeks different cohort groups of teachers enrolled in the course came to the library instead of to their grade level session in other classrooms. Groups ranged in size from eighteen to twenty-four (18 – 24). For most groups the teachers worked two to a computer (and rarely three), which provided moral support for the beginners and cooperative sharing sessions between those with more experience. The sessions were taught each week by the same member of the Teacher Support Team (who is also an author of this paper), and one or two university graduate student volunteers. A revised one-page teacher questionnaire (Appendix B) was used to ascertain the particular skill levels and instructional needs of the teachers.

The new organizational structure for the technology component required that mixed-ability groups be served in the same session. Therefore the information from the teacher questionnaires was used to develop a menu-driven program with a progression of specific skills and explorations for a mixed-ability group (See Appendix C.). Teachers participating in the technology session were able to start at their own skill level and to progress through the tutorials and instructions at their own pace, with help from the instructors at any time. Each teacher was paired with another teacher of equivalent experience and skill level for the duration of the computer session, which lasted for two hours. Evaluations after these sessions were more positive: "Big improvement from last quarter!", "I really learned how to incorporate math, science, and technology!", "The technology session was great; I want more!" Teachers at these sessions were all from USI schools, and later received additional support from the TST members assigned to their own building on their own computers.

The greatest indication that this design more successfully met the needs of the teachers came with the final evaluations for the course. Numerous teachers wrote that they had enjoyed the computer sessions so much they had purchased a personal computer for their use at home; several even mentioned that they were now connected to the Internet at home so they could use the online resources for their lesson planning.

Building Level Development of Teacher Training Teams involved the selection of four teachers from each of four district middle schools. These teacher teams agreed to participate in a water quality and distance learning program which had outside grant funding. The teacher teams received additional extensive technology training for a week during the summer in a district computer technology lab. Each teacher was given a laptop computer for use during the three year grant to facilitate electronic compilation of data of river quality measures, and to establish regular electronic communication links between the middle schools involved in the water quality study. Students and their teachers in this urban district studied and collected water quality data and environmental data on rivers near their schools, shared the data with the other more rural schools, compared the collected body of data, and tried to determine effective water quality protection policies and procedures which could be implemented to promote clean water and improved environmental conditions in each area.

These teacher teams shared their new skills with the hardware, probeware, and software they were using in the project with other teachers in their buildings through ongoing formal and informal training sessions. The project continued for three years, during which time numerous professional development opportunities for building teachers were held. Several of the teachers in our university course had benefited from these sessions, and shared some of their experiences with the rest of us. As a motivation to complete the study in all aspects, at the end of the grant period ownership of the laptops reverted to the teachers, provided all final project reports were delivered to the funding agency.

This training was provided by staff members within the district who are not members of the USI program per se; there are a large number of highly qualified teachers involved in technology training across our district. The model was efficacious, and has been included here for contrast and comparison. The project would be costly to implement, but if outside funding could be secured, this program could be replicated elsewhere to good effect. An important positive feature of this design was the real-world application, the problem-based design, and the regular communication and comparison of results with middle schools in other parts of the state.

Individualized On-Site Instruction was given to teachers in their classrooms and school buildings by members of the USI Teacher Support Team as part of ongoing professional development supported by the NSF grant to the district. The specific individual attention allowed teachers to develop new skills with the technology available to them, focused on educational objectives and needs determined by the teachers, and was timed to suit the schedule and needs of the individual teachers. The technology involved varied between buildings. School staff members were empowered to determine how technology funds would be spent, consequently there was great variety between buildings in platform, focus, and form. Most buildings chose to upgrade from Apple IIe computers to higher powered models, which were placed in classrooms or central computer labs according to the plan developed by the teachers in the building. Support for the teachers as they developed these plans was provided by members of the USI staff, by members of the Teacher Support Teams, and by library media specialists with strong technology backgrounds and experience.

Once the computers were in place, the same district technology experts, members of the Teacher Support Team, experienced teachers in the buildings, and some community members helped others with less experience start learning how to operate the computers, and how to use them in their instruction effectively. The particular focus of these sessions was effective science and mathematics instruction, incorporating the Internet and materials from the World Wide Web, and using the computers as tools to report the results of hands-on investigations through manipulation and presentation of data. In a few buildings these sessions were open at no charge to parents and community members as well, through a sign-up procedure. Different topics for the after school sessions were determined in advance, and participants were encouraged to sign up for the particular computer training classes they needed. Building teachers have now taken over these sessions in several locations.

The critical nature of the support provided to the classroom teachers by members of the Teacher Support Team can not be overlooked. Many teachers felt threatened and intimidated by the new computers sitting in their classrooms, and have expressed their gratitude for the help and encouragement and technical expertise the TST's bring with them for the first several times the computers are used. Science educators in other districts who seek to encourage other teachers to begin using new technologies as integral components of science investigations should be encouraged to be in the classroom with the less-experienced teachers whenever possible. The moral encouragement itself, and the opportunity to take the first steps towards technology integration while someone else is there to help if disaster strikes make it well worth the effort.

District-Based Technology Courses have been provided at no or low cost for district teachers at centralized sites after school hours and during the summer. Teachers volunteer to participate in these high-demand courses taught by local consultants from the school district. Each course has been self-paced and hands-on, usually occurring over a two day period. Course topics have ranged from ClarisWorks to HyperStudio, and from specific CD ROM titles to the Internet. Teachers have used a manual during the technology sessions to learn specific computer skills, and moved at their own pace during the entire class. Assistance was available from the trainer when required, along with suggestions for how the particular skill, hardware option, CD ROM, or software could be used by the teachers in their classrooms.

This model was self supporting and could be readily replicated in other districts. Motivation to learn has never been an issue with this model in the district, because the teachers sign up to take the classes of their own volition. Should technology training through a similar model become a required opportunity, the instructor would have to work harder to help teachers see the benefits they would reap should they adopt new technologies.

Findings:

Our interest in comparing the efficacy of these different approaches prompted us to engage in an *ex post facto* comparative evaluation. The study is an Action Research Project, based on knowledge gained from practical experience rather than using established theory as the framework (Carr and Kemmis, 1983). Our approach employed the use of qualitative data in the assessment of teacher learning and satisfaction. Different evaluations were used in each setting, however the open-ended free responses (described earlier, p4) were the most authentic, and provided significant insights into those aspects of the learning experience which teachers valued the most. In addition the comments from one session were used to improve the experience for the next groups of teachers.

The models implemented with teachers in urban areas may differ from those with teachers in suburban or rural schools, however, the initial phase of development of technology training for any group of teachers must include identifying the needs of the specific group of educators who will participate. Several instruments were piloted to survey teachers prior to the technology sessions. The survey tools were designed to gauge the teachers' affinity for computer technology and their attitudes about learning to use technology in their classrooms. The earliest survey was used to sort teachers into five homogeneous sections, based upon the skill levels and experiences with technology that teachers reported about themselves. It became apparent that while teachers might feel comfortable using technology which was available to them in the buildings (an old Apple IIe computer, for example), the switch to a more recent upgrade or to a different platform put the teachers in unfamiliar ground, and removed a large measure of their self-confidence.

Questions used in any survey therefore need to be written carefully, with consideration for the range of potential answers for each item. Teachers need to understand that honest assessment of their skill levels will result in the most accurate placement for each of them, whether the sessions focus on particular skills, pedagogical objectives, and/or specific software or hardware platforms. Allowing teachers to switch assignments as necessary to find the right comfort zone would be beneficial, for it would allow them to be self-directing. "Adult learners usually perceive themselves to be independent and responsible for their own actions and have a need to be directly involved in planning and directing their learning activities." (Ference, 1994)

The teacher comments compiled through evaluations of training sessions indicated that they were most satisfied when workshops and ongoing professional development were designed with their own specific needs in mind. Teachers are chronically short of time, and appreciate workshops and professional development opportunities which provide maximum efficiency and efficacy. By asking teachers what they need, and by listening to their replies, the needs of the teachers can be addressed. Technology training sessions should be shaped to reflect the hardware, software, and computer-based educational media available to teachers, to include training in the Internet and on the World Wide Web if access is available to the teachers, and to model how technology can be used as a tool for standards-based science education. Finally, a very critical component of an effective technology professional development opportunity would be the engagement of the teacher in the instruction.

Significance:

Advances in our understanding of the world and the sheer body of knowledge are increasing exponentially. Scientists especially are making new discoveries, developing new products, and creating innovations in many areas that impact our lives. The very speed and incredible volume of these changes have created dilemmas for teachers. Textbooks can be outdated and inaccurate before they are even published. So-called 'facts' we were once asked to memorize as students have been proven erroneous, making any strict and narrow focus on specific content of questionable value for our students.

The process skills of synthesis and evaluation, problem solving, and learning how to learn have become even more important than before, as reflected in the new science standards published by the National Academy of Sciences. These reflect the current trend in education to move away from traditional pedagogy involving lectures and worksheets, with the idea that these do not serve our students as well as hands-on investigations. Explorations and inquiry-based instruction provide the experiences and understandings which students are presumed to need to construct their own knowledge. Teachers still carry the responsibility for preparing students for the future, yet the jobs these students will find may not even be invented yet.

The use of technology offers a currency and an access to knowledge unparalleled by other resources, and teachers deserve to be as capable of utilizing the full capabilities technology offers as anyone. The difficulty has been to provide the support and professional development that teachers need to become proficient, and to do so in a timely and seamless fashion. We recognize that successful technology instruction must address a variety of adult learning characteristics, because teachers, like other adults, seek independence, feel solution-driven, are skill-seeking, and benefit from hands-on opportunities (Ference, 1994). In addition, providing a range of services and support over time has been shown to be critical to the success of the technology training. Connecting the use of technology to the content requirements and learning objectives has been mandatory. Allowing teachers to learn at their own pace, to be treated with professional courtesy, and to have a voice in their own learning are well advised. Limiting the scope of the technology training to the teachers' needs also prevents the sessions from being overwhelming. Matching the model to the situation can ensure success, and can significantly increase the use of technology by teachers in their classrooms. Ultimately this must be the goal of technology training sessions and professional development in the use of computers in science education.

Our concern has been for the student in the urban school, who may have limited access to computer technology at home, and who historically has been disadvantaged economically. Exposure to and familiarity with computers and modern technological advances have become even more important, especially for our young people. However the teachers themselves must be proficient with computers to be successful in preparing students for the many applications of computer technology today and tomorrow. Our experiences with the multiple models of transferring technological skills, and the feedback and evaluations from the teachers at the conclusion of the inservices, were used in the design of subsequent technology sessions for the teachers. We recognize that the teachers' own interests in the task of learning how to use the technology available to them to improve their teaching contributed to the successes we achieved, and we are grateful to them for their comments and evaluations of the professional development sessions they attended.

The challenges facing the classroom teacher as we move into the twenty-first century are large enough without removing the power of technology from their repertoire. It behooves those of us involved in professional development of teachers whose skills with technology may be more rudimentary, to recognize that all teachers want what is best for their students, and that all teachers do their best to meet their students' needs. We should do no less, and perhaps more, if we are to successfully design and implement technology instruction for educators in urban, rural, and suburban areas of the country.

Literature Cited:

Barksdale, J.M. (1996). New Teachers Unplugged: Why Schools of Education are Still Sending You Staff You'll Have to Train in Technology. *Electronic Learning, (15)5, 38-45.*

Boyd, E.G. (1997). Training-On-Demand: A Model for Technology Staff Development. *Educational Technology*, 37(4), 46-49.

Carr, W. & Kemmis, S. (1983). *Becoming Critical: Knowing Through Action Research.* Victoria, Australia: Deakin University Press.

Dori, Y.F. & Barnea, N. (1997). In-Service Chemistry Teachers' Training: the Impact of Introducing Computer Technology on Teachers' Attitudes and Classroom Implementation. *International Journal for Science Education*, 19(5), 577-592.

Ference, P.R. & Vockell, E.L. (1994). Adult Learning Characteristics and Effective Software Instruction. *Educational Technology*, 34(4), 25-31.

George, G. & Camaranta, M.R. (1996). Managing Cyberanxiety: The Role of Self-Efficacy in Decreasing Resistance to Change. *Educational Technology*, 35(5), 5-16.

Goldberg, B. & Richards, J. (1995). Leveraging Technology for Reform: Changing Schools and Communities into Learning Organizations. *Educational Technology*, 35(5), 5-16.

Lieberman, A. (1995.) Practices That Support Teacher Development: Transforming Conceptions of Professional Learning. *Phi Delta Kappan*, 76(8), 591-596.

NEA Today. (1998). Building the 21st Century School. National Education Association,16(8), 29.

National Center for Education Statistics. (1996). Advanced Telecommunications in U.S. Public Elementary and Secondary Schools. U.S. Department of Education, cited in Technology Counts: Teacher Training. *Education Week on the Web* [Online]. (1997). Available: http://www.edweek.org/sreports/tc/teach/te-c2.htm. [1998, February 1].

Raizen, S.A. (1997). Making Ways for Technology Education. *Journal of Science Education and Technology*, 6(1), 59-70.

Recommendations for Policymakers and Educators, in *Plugging In, Choosing and Using Educational Technology* [Online]. (No date). Available: http://www.ncrel.org/sdrs/edtalk/recommend.htm [1996, October 10].

Wise, A.E. & Leibbrand, J. (1996). Profession-Based Accreditation: A Foundation for High-Quality Teaching. *Phi Delta Kappan*, 78(3), 202-206.

Woodrow, E.J., Mayer-Smith, J.A. & Pedretti, E.G. (1006). The impact of Technology Enhanced Science Instruction on Pedagogical Beliefs and Practices. *Journal of Science Education and Technology, 5(3), 241-252.*

Appendix A : Technology Survey – for Concurrent Ability-Related Sessions

(Please complete this form and return it to your instructors.)

Name: ______________________________ School: ________________
Grade Level: School Phone: _____________
E-mail address (if available) ____

1. Place a mark on these grids to represent your experience and comfort level with computers:

|____|

Uncomfortable Very Comfortable

|____|

Inexperienced Very Knowledgeable

2. a. Do you have access to a computer? Yes _____ No _____ (If no, go to #3.)
2. b. If Yes, where is the computer? (Check all that apply.)
   _____ In classroom
   _____ In school building in _________
   _____ At home
   _____ Other ____________________
2. c. Do you have access to the Internet on any of these? Which ones? What is your server?
2. d. Do you have full access to the World Wide Web? Yes _____ No _____
   If yes, where? ____
2. e. List three of the most frequent activities for which you use a computer:

3. With what frequency do you use email? (check the most appropriate)
_____a. Have never used it.
_____b. Send messages occasionally.
_____c. Use on almost daily basis.
_____d. Use regularly and subscribe to listservs.

4. Have you ever used computers for instruction? Yes _____ No _____
If yes, briefly describe what you have done:

5. Do your students have access to computer networking activities? Yes _____ No _____
If yes, how do they use them?

6. Please list, on the back of this form, any topics you might be interested in learning with respect to computer technology.

Appendix B : Technology Survey – Revised - for Mixed-Ability Sessions[1]

(Please complete this form and return it to your instructors.)

Name: ______________________________ School: ________________
Grade Level: School Phone: _____________
E-mail address (if available) ____

Please rate yourself by circling a number of the scale of 1 – 5. Your answers will be used to help the instructors plan your technology sessions. A "1" means in general you are very knowledgeable, experienced, and comfortable in a particular area. A "5" means you may not be knowledgeable or experienced, or do not have a high comfort level in this area:

	knowledge	experience	comfort
1. Use of computers for word processing	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Use of computers for spreadsheets	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Use of computers for databases	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Use of computers for Internet/email	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Use of computers to access WorldWideWeb	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Use of the Internet/Web in instruction	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Use of other technologies in instruction	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

such as ____

8. a. Do you use a computer to help with your teaching? Yes _____ No _____ (If no, go to #9.)
   b. If Yes, where is/are the computer(s)? (Write in the number of computers for each location.)
      _____ In classroom - which platform? PC [ ] Macintosh [ ] Both [ ]
      _____ In school building, in the ________________________
      _____ At home - which platform? PC [ ] Macintosh [ ] Both [ ]
      _____ Other ____________________
   c. Do you have access to the Internet on any of these? Which ones? ____________________
   d. Do you have full access to the World Wide Web? Yes _____ No _____
      If yes, where? ____
   e. List the three activities for which you use a computer most frequently:

9. With what frequency do you use email? (check the most appropriate)
_____a. Have never used it.
_____b. Send messages occasionally.
_____c. Use on almost daily basis.
_____d. Use regularly and subscribe to listservs.

10. If your students have used computers for learning, please briefly describe what they have done:

11. Please list, on the back of this form, what you would be interested in learning with respect to computer technology.

[1] for an additional technology survey, please access the following URL:
http://www.columbus.k12.oh.us/techpage/r9_surv.htm

Appendix C : A World Wide Web Training Manual

(Note: each of the following menu items included a description of specific procedures, and explanations of the sites teachers would access. The district's web page, for example, has a section of teacher resource links, written by one author of this paper, which was changed to meet the needs of the specific teacher cohorts in the class. For example, when the fifth grade teachers were scheduled to come to the technology session, the links were changed to reflect the fifth grade course of study. The training manual in its entirety was deemed too long to be included in this paper; what follows are the headings from the menu selections only, included here as a guide to the progression of skills.)

The Boarding Area:

1. The Mouse.
2. If the computer freezes, don't panic.
3. Safety Checks.
4. Use Policies.

The Runway

1. Wake Up Call.
2. Double Click on "The Internet" – accessing the Internet!
3. Learn about Microsoft Internet Explorer (or Netscape).
4. Type in the address for the district's home page: (The specific URL was omitted here.)
5. Use an online tutorial to become acquainted with the World Wide Web.
6. Follow a link in your Web Browser.
7. Print from Explorer (or Netscape).
8. Use a search engine to find material and information on a topic that interests you.

Maintaining Altitude

9. Do a specialized search for good science educational sites.
10. Send an email using a Web browser.
11. Find science lesson plans you can use in the classroom tomorrow!
12. Look at the HTML that is behind the Web page you are exploring.
13. Clear out your cache.
14. Turn off graphics in your browser so pages load faster.
15. Capture image files to a disk for use in a slide show in class.
16. Learn about the Bells and Whistles of the Web: [Download them later at your school!]
    Adobe Acrobat, Shockwave, QuickTime Virtual Reality, HyperStudio online, Real Audio
17. Interactive science explorations online.
18. Learn about how to write a web page for your school or your classroom!
19. Conduct some research and help us all: What are "cookies"?

Landing

20. Get ready to land and to exit the Web.
21. Exit from the browser and close the connection.
22. Last step: turn the engine (computer) off!

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