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RUNNING HEAD: The Eruditio Project

The Eruditio Project: Evaluation of an Internet Training Program for Classroom Teachers

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Although computers have been used in education for years, the use of on-line technology is a much newer phenomenon (Cuban, 1986). A report published in Workforce Economics Trends reported that although 74% of people surveyed strongly agreed that computers would improve education quality, 42% of those polled believed schools were behind the technology curve (National Alliance of Business, 1997). This perception is supported by the fact that the majority of K-12 teachers do not receive initial, nor ongoing training in the use of technology in the curriculum. Teacher training is mandated in only 13% of school districts surveyed by the National Center for Education Statistics (1996) while 51% of technology training is teacher-initiated. Only 15% of United States teachers have had nine or more hours of technology training. This statistic is unfortunate as the more training teachers receive, the better off their students are. Research has indicated that students of teachers with more than ten hours of technology training outperformed students of teachers with five or fewer training hours (Software & Information Industry Association, 1999). In a study of Ohio elementary school educators identified as being exemplary users of technology, 95% of respondents reported that they acquired at least some of their knowledge of technology on their own while over 60% identified learning on their own as the primary source of their knowledge acquisition (Berg, Benz, Lasley, & Raisch, 1997). In 1993, Honey and Henriquez reported 88% of respondents were self-taught. In fact, lack of training has been argued to be the most critical reason for the absence of technology use in schools (Coley, Cradler, & Engel, 1997; Simonson & Thompson, 1997).

Successful implementation of technology in the classroom is predicated on teachers first being given the time to receive training, and then actually receiving sufficient training. Teachers need instruction not only on the basic tools and skills needed for on-line communication and research but also how to integrate this knowledge into their instruction (Alagbe & Lemlech, 1998). A 1995 study by the U.S. Congress Office of Technology Assessment acknowledged that while progress has been made in training educators to use basic computer technology, specific training on integrating technology into the curriculum was lacking. The study also found this type of training to be one of the most important factors in the successful implementation of educational technology in the schools. In this age of technology, extensive training in computing applications and their integration into the curriculum is a prerequisite for effective classroom instruction (Software & Information Industry Association, 1999).

Eighty percent of the respondents of a random sample of 6,000 educators surveyed across the United States in 1996 said that insufficient training for teachers was one of the biggest obstacles to increasing use of Internet-related technologies in the classroom (Market Data Retrieval, 1997). Findings from the most recent Software & Information Industry Association Research Report on the Effectiveness of Technology in Schools further indicates that the amount and type of teacher professional development as well as how educators decide to actually use computers in instruction may matter more than the

frequency with which technology is used (Software & Information Industry Association, 1999). Data from a national survey of teachers involved in the National School Network (NSN) funded by the National Science Foundation indicated that even among Internet-using teachers from schools already having achieved a high level of Internet use, resources (including training) for Internet use and integration in the curriculum were reported as being insufficiently present (Ravitz, 1998).

The importance of teacher training in technology has been acknowledged at all levels, from public opinion up to and including mandates and initiatives from the federal government. As McGrath and Baron (1998) point out, former President Clinton, in his 1996 State of the Union address, reiterated the need for teacher training on Internet-based computer technology: "Our challenge is to provide Americans with the educational opportunities we'll all need for this new century. In our schools, every classroom in America must be connected to the Information Superhighway with computers and good software and well trained teachers". In addition, Clinton's May 1996 announcement of the "21st Century Teachers Initiative" set forth a goal to train half a million teachers in the use of innovative educational technology resources including those based on the Internet.

Training teachers on the use and integration of Internet-based resources into the curriculum has been demonstrated to have curricular and pedagogical advantages over other, more traditional forms of computer technology such as software and CD-ROM's. These advantages include investigations of "real time" data and information; collaboration with other schools, cities, states, countries; and collaboration with actual scientists or other experts in a field (McGrath & Baron, 1998). Other important uses of Internet technology also have been identified, such as the ability to integrate content areas, provide individualized and interactive learning, communicate with parents or family of students, and motivate students through the use of additional teaching techniques (Berg, Benz, Lasley, & Raisch, 1997). In addition, use of the Internet/World Wide Web allows access to resources that complement those available through more traditional sources such as books, magazines, encyclopedias, etc.

A number of advantages related to learner variables and characteristics also exist. Through the use of the Internet and other network technology, students are afforded a real, authentic audience for their learning and output (Roschelle, 1994). Studies also have found that when students are exposed to curricular uses of the Internet, they apply themselves for more sustained periods of time, take more ownership for their learning, and demonstrate increased interest in international events and other cultures (Ravitz, 1998). A meta-analysis done by Kulik & Kulik in 1991 revealed that when students receive instruction accompanied by the use of computers, they learn more, learn in a shorter amount of time, and enjoy their classes more. More recent meta-analyses corroborate increases in student achievement, attitudes, and amount of student-student and student-teacher collaboration and interaction, as well as document increases in student self-concept, motivation, and quality of work (Sivin-Kachala, Bialo, & Langford, 1997; Software & Information Industry Association, 1999). A final benefit is that the use of computer technology affords students experience and practice in applications needed to be successful in the workforce of the 21st century.

The need for teacher training in Internet-related technologies has begun to be addressed across the country. These programs include Tennessee's ConnecTEN; a collaborative program utilizing a partnership between the Baltimore County Public Schools and Johns Hopkins University; the Stevens Institute of Technology "Alliance for Training K-12 Teachers in Instructional Technologies: A National Internet-in-Education Teacher Training Program"; a program initiated at McGill University in Quebec; and the New Jersey

Networking Infrastructure in Education project (NJNIE) funded by the National Science Foundation (NSF). Tennessee's ConnecTEN project was established in 1996 with the goal of not only making Tennessee the first state in the nation to connect all of its 1560 public schools to the Internet via a single network, but also to provide necessary hardware and software as well as train teachers in the use of the Internet (Maxwell, 1997). The project initially was structured to provide direct training in the uses of technology as well as how to use the Internet across the curriculum to 215 teams of educators. Those trained initially were, in turn, to become peer trainers for the remaining teachers in their district. Training also was offered through sessions coordinated by local school boards, colleges and universities, technology conferences, seminars, and in-service trainings, but teachers primarily had to pursue this sort of training on their own time and at their own expense (Maxwell, 1997).

The partnership between the Baltimore County Public Schools and Johns Hopkins University provides technology training and development to K-12 educators, uses "Train the trainer" peer instruction, stresses the importance of administrator/educator partnerships, includes participants who have demonstrated interest and motivation to use technology in their instruction, and provides for the use of home school facilities in the practice and implementation of technology (Nunn, McPherson, & Rust, 1998). An important component of this program is the emphasis placed upon the partnerships between educators and their respective administrators: the successful adoption of any educational innovation has been demonstrated to be linked with involved and committed administrators (U.S. Congress, Office of Technology Assessment, 1995).

The "Alliance for Training K-12 Teachers in Instructional Technologies: A National Internet-in-Education Teacher Training Program" provides for partnerships with community colleges in providing professional development training in technology as well as uses peer mentors as trainers or "turnkey" trainers to go back to their respective schools and districts (McGrath & Baron, 1998).

McGill University in Quebec developed an "Internet Resources Course" in an attempt to provide further training to Canadian teachers. The components of McGill's program deemed necessary for the program to be successful include: an applied, as opposed to a theoretical, approach including interactive, hands-on, meaningful exercises; asynchronous (e-mail) and synchronous (Internet Relay Chat) communication; provisions for course modifications and feedback to be made without delay; training in appropriate network etiquette, collaboration in virtual environments, and how to process and filter large amounts of information; and technical support (Silva, 1996). The course operates under an apprenticeship approach in which students are recognized and given feedback as individuals and as collaborative groups. E-mail was used to provide the means for collaboration, discussion, contact with experts in the field, and the receipt of course materials (Silva, 1996).

The NJNIE project began with the goal of improving science and mathematics instruction through the use of the Internet. Improving connectivity through the provision of hardware and software, providing professional development to faculty, and actual application of curricular units integrating the Internet into the classroom were key components of this program. Attempts also were made to link classrooms, both within and across schools, through collaborative projects as well as to promote the use of peer networks via listservs and newsgroups. Finally, the NJNIE project also included, as many similar programs have, a train-the-trainer model in an attempt to facilitate the diffusion of training and information beyond those teachers initially able to participate in the project (Wilder, Niyogi, & Linden, 1998).

It has been demonstrated that an important component in the design and implementation of a teacher technology-training program is the use of peers as participants in a common network, as mentors, and as instructors. Connecting educators via telecommunications/Internet technology may begin to help end isolation in a profession where even teachers in the same school feel isolated from one another (U.S. Congress, Office of Technology Assessment, 1995). In addition, research has substantiated that educators identified as exemplary in their use of technology benefit from networking with other technology-using educators (Software & Information Industry Association, 1999). The use of peer mentoring and coaching rather than didactic, lecture-based instruction delivered by an "expert" has been further advocated as a result of studies reviewed by ETS (Coley, Cradler, & Engel, 1997). These studies revealed that peer networking about experiences using telecommunications technologies were a helpful component of staff development. In fact, the extent to which individuals participate in a network of similar users of technology has been shown to play an influential role in the adoption of innovation (Rogers, 1995). In regards to instruction by peers, studies have found that teachers would prefer to be taught technological concepts by someone who was also a teacher and also teaching in the same content area (Alagbe & Lemlech, 1998).

It is not only important to impart knowledge of the technology through networking and mentoring by educator peers, but also to ensure that educators are instructed on how to actually implement the technology, especially with a learner-centered, constructivist orientation. This type of learning, commonly referred to as active learning, has been proposed to be a social, interactive, constructive process that results in more effective learning and better retention of knowledge (Piaget, 1959; Vygotsky, 1978). It has also been described as a forum in which the learner "actively collaborates with the medium to construct knowledge" (Kozma, 1991, p. 179). Active, or constructivist, learning stands in opposition to the more traditional didactic, or instructivist, method of learning; one in which early uses of technology in the classroom were for drill and practice-type exercises, and where instruction is given, as opposed to learning being constructed (Alagbe & Lemlech, 1998; Cuban, 1986). Incorporating use of the Internet into the classroom allows for the inclusion of a more learner-centered and constructivist approach to education by allowing students to follow their own paths of interest in a realm where the teacher is not the only source of knowledge. Studies have found that four times as much information is retained when instruction involves the interactive use of computers than when information is presented in lecture format or computer-based drill and practice (Green, 1996; Northup, Barth, & Kranze, 1991).

Jonassen (1994) espouses that constructing a learning environment that engages learners in knowledge construction instead of reproduction, discussion and reflection instead of reception and repetition, and collaboration versus competition results in more productive and meaningful uses of technology. Training guidelines developed by the National Staff Development Council call for a more constructivist, cooperative method of instruction (Sparks, 1994). They advocate collaboration among teachers, administrators, peers, researchers, and students to construct their own knowledge of teaching and learning using technology. By actively involving teachers in their own learning about on-line technology, collaborative and constructivist attitudes and behaviors are modeled in the hopes that they will eventually be implemented in the teachers' own classrooms. Several studies have confirmed the effectiveness and benefits of collaborative or cooperative learning (see Slavin et al., 1985 and Slavin, 1996 for in-depth discussions of the concept). The use of Internet communication tools such as e-mail, mailing lists, and chat sessions allow such collaboration across geographic boundaries. Forms of on-line communication and training such as these have additional, demonstrated advantages over face-to-face instruction. These include lower travel and training costs; flexibility; and the ability for trainees to share insights and support via e-mail, teleconferencing, and electronic bulletin

boards, while still offering individual attention and support (Huang, 1997).

The present study focuses on the evaluation of the Erudition Project. The USWest/NEA Arizona Teacher Network Project (Eruditio Project) is a collaborative effort among Arizona State University, Arizona State University-West, Northern Arizona University-Yuma, Northern Arizona University-Flagstaff, Grand Canyon University, University of Arizona, Arizona Education Association (AEA) and the Arizona Department of Education (ADE). The goal of the Eruditio Project is to integrate technology and telecommunications into K-12 curricula to improve student achievement by providing face-to-face and on-line training for educators throughout the state of Arizona. The project was designed to offer training in the use of Internet-based technology in general, as well as specific training in the integration of this technology into the curriculum. Specifically, the project provides programs and support services for educators throughout the state in order to overcome geographic barriers; enable educators to access, contribute, and create new educationally relevant information on and to the Internet; implement current technology including access to the World Wide Web; participate in discussion groups and use electronic mail; establish collaborative networks of pre-service and in-service teachers, students, administrators, professional education organizations, and universities; and establish a model and knowledge base for future education networking projects, including a "train the trainer" model of dissemination.

There are a number of components in place in the Eruditio project that mirror those found in similar teacher training programs discussed earlier. The first of these is the presence of demonstrated support by administrators. As recommended in projects structured to encourage use of educational technology in schools, the Eruditio project required applicants to obtain administrator support and commitment prior to consideration for participation. This support included a commitment to providing access to a phone line and release time for participating teachers to attend training sessions; willingness to use technology themselves; willingness to implement incentives for teachers to use technology through district in-service training; and a commitment to working as a team member with those involved in the district in-service training.

In addition to the collaboration required between participants and administrators, another similarity between the Eruditio project and others like it (e.g., the partnership between Baltimore County Public Schools and Johns Hopkins, the outreach to Canadian K-12 educators provided by McGill University, and the Stevens Institute of Technology "Alliance" which partners K-12 schools with community colleges) is the collaboration between K-12 schools and post-secondary institutions. Collaboration of this sort allows for the provision of additional, expert resources for the training, development, and mentoring of the K-12 educator participants. In the Eruditio project, the collaborating universities also donated credit hours to project participants. Another similarity with other programs is the make-up of the participant group. As in the Baltimore County Public Schools/Johns Hopkins partnership, the target participant group for the Eruditio project included pre-service and in-service K-12 educators who identified themselves as novice computer/telecommunications users exhibiting an interest in and motivation to use technology as a teaching tool. These educators also needed to demonstrate a willingness and vision for using technology and telecommunications in the classroom to improve curriculum instruction and student performance.

Further training also was provided through a final source of similarity between the Eruditio project and other similar training programs: participants selected for participation in the Eruditio project were required to commit to staff development and be willing to conduct in-service training programs on the use of technology to a minimum of ten

teachers or administrators in their district. Aforementioned programs such as the Tennessee's ConnecTEN, Baltimore County Public Schools/Johns Hopkins partnership, and the Stevens Institute of Technology "Alliance" all used a similar "turnkey" or "train the trainer" approach. In this manner, many more teachers than those originally chosen to participate directly in the training programs are able to receive technology training. Another benefit to the use of participating teachers as trainers is the previously discussed idea that educators have demonstrated a desire to learn from peers. Networks of technology-using peers have also been shown to be beneficial in offering on-going support and coaching. Finally, interaction with peers serves to provide a community or network that may help overcome the isolation that many feel is inherent in the teaching profession.

Collaborative learning was an important component in the Eruditio project. By providing participants with collaborative groups in which to work, educators are able to share ideas and information, provide feedback, motivate and encourage each other, and learn and grow as a group. Participants in the Eruditio project were part of two related, yet distinct, collaborative peer groups. The larger of the two included participation in a peer group based on content area interest. These groups were facilitated by someone experienced in the use of Internet technologies and communication. This Project Facilitator served as support for participants by promoting regular interaction, communication, feedback, and encouragement. These peer groups also provided the means for individual educators to construct and reconstruct their knowledge of technology and its uses in the curriculum by allowing for the exchange of ideas and information. The smaller collaborative group consisted of partnerships within the larger content area groups. Partners collaborated to complete an on-line assignment demonstrating how they integrated an Internet-based project into their curriculum. In addition, partners worked together to develop a web site based on their team project.

The literature discusses multiple positive outcomes of training and encouraging teachers' classroom use of not only computers in general, but also specifically the Internet. The Eruditio project was initiated to engender similar positive outcomes for both teachers and students. The present study provides an evaluation of the Eruditio project and focuses on the following two questions: (1) - Were there positive changes in teacher behaviors, including an increase in teachers' abilities to use and actual use of computers, an increase in teachers' perceptions (comfort with and desire to use) of using computers, and an increase in teachers' reliance on student input into curriculum and instruction? (2) - Were there improvements in student outcomes, including an increase in students' frequency of computer use as well as active involvement in the classroom, and an increase in students' effectiveness of computer use as well as active involvement in the classroom?

Method

Participants

Participants were solicited through a number of avenues. Project personnel gave presentations to national professional educational organizations such as EdMedia, the American Educational Research Association (AERA), and the Association for Educational Communications and Technology (AECT). In addition, presentations were given to local school districts and libraries in the state of Arizona in the USA. The AEA and the ADE also distributed approximately 1500 brochures and applications to AEA and National Educational Association (NEA) members, as well as to every school district in the state of Arizona.

Application materials included the application form, two letters of recommendation from

teacher colleagues, a one-page narrative, a signed administrative endorsement form, and a list of three references. Six hundred applications were received and reviewed. Final selection of 181 participants was based on the following criteria: connectivity ability of the applicant; geographic representation of all districts within the state; equity in representation of elementary and secondary schools; diversity of content areas; and equity in representation of culturally diverse and at-risk populations in K-12 classrooms. An effort was made to include novice computer/telecommunications users who exhibited an interest in and motivation to use technology as a teaching tool. Of the 181 participants selected, complete demographic data is unavailable for eight participants.

Participants included 124 female and 49 male teachers. Mean years of teaching experience for the sample was 12.1 years (SD = 8.3). Years of experience ranged from one year to 37 years. Reported grade levels of teaching assignments were as follows: elementary (teachers from schools including grades PK-5 as well as teachers from K-8 schools; n = 58; 35.9% of total) and higher grades (teachers from middle schools, grades 6-8, and high schools, grades 6-12 and 9-12; n = 106; 64.6%). Subject areas reported by the participants include: multiple content areas (n = 68; 42.0% of total); science (n = 30; 18.5%); humanities (social studies; n = 16; 9.9%); math (n = 12; 7.4%); language arts (n = 10; 6.2%); special education (n = 7; 4.3%); technology (n = 7; 4.3%); ESL (n = 3; 1.9%); and other (n = 9; 5.6%). The "other" category includes physical education, counselors, gifted and talented teachers, and vocational or family resource teachers. Not all participants reported subject area information. Of the 181 participants, 76 were taking part in the project with other colleagues from their school. Forty-four participants had one other colleague from their school participating in the project; 19 had two other colleagues participating in the project, eight had three colleagues from their school also in the project, and five had four participants from their school taking part in the Eruditio project.

In exchange for participation in the project, participants received a laptop computer with the necessary modem and software to connect to the Internet, two (one each year) face-to-face training sessions, continuous on-line training via interactive modules and structured chat room discussions, technical support, curriculum and instructional design support for required project development, and the opportunity to earn three hours of continuing education credit from any of the participating universities (Arizona State University, Grand Canyon University, Grand Canyon University, and University of Arizona). At the completion of the project and after fulfilling all project requirements, the computer, modem, and software became the property of the participant.

Of the 181 selected participants, nine did not complete the training and withdrew from the project. Reasons for attrition included lack of time, personal or family circumstances, and professional over-commitment. Vacant spaces in the project were reassigned to a teacher within the same school district based on administrator recommendations.

Instruments

Participants were given an initial pre-training questionnaire to determine their access to and understanding of technology, the frequency of their use of technology, their attitudes toward technology, and their current skill levels in using technology. The questionnaire included five-point Likert scales asking participants to rate their desire, ability, comfort, and experience with activities and applications of technology, as well as to rate the frequency and effectiveness of various computer-based activities and applications. Participants also were asked the following open-ended questions: why they chose to apply to participate in the project; what they would like to accomplish from participation in the project; anticipated challenges in participating in the project; how they thought the

project would change classroom practices; and what they thought impediments to implementing ideas from the project in the classroom would be. Survey questions were grouped into more general indicators, or categories of interest, to represent the research questions and related areas discussed below and the quantitative values of the responses were summed to produce indicator scores. Participants were given this same questionnaire at the end of training, and as a result, pre-and post-training data was made available for analysis. The time lapse between pre and post-questionnaires was about 2 years.

Research Design

A within group, repeated measures design was used for analysis of the following two research questions: the first question is concerned with the presence of positive changes in teacher behaviors and the second with improvements in student outcomes. Within the first research question, there were three areas of interest: teachers' abilities and experiences using technology, teachers' perceptions about the use of technology, and teachers' reliance on student input into curriculum and instruction. The second research question focused on two areas: the frequency of students' computer use and students' active involvement in the classroom and the effectiveness of students' computer use and students' active involvement in the classroom. Repeated measures analyses of variances (ANOVA's) were implemented to address each of the research hypotheses. Each of the hypotheses were tested at the $p < .01$ level of significance.

Results

Descriptive Statistics.

Histograms of all variables were generated and examined for normality. Histograms indicated reasonably normal distributions although, as might be expected with this type of sample (participants self-nominated for training of high-interest), the majority of responses to questions regarding various aspects of computer knowledge, use, and experience resulted in indicators that were negatively skewed (i.e., mean levels of computer familiarity higher than would be found in the general public). However, because the sample size was adequate and the distributions were not severely non-normal, this data was determined to be robust to violation. Table 1 presents means and standard deviations obtained on the summed indicator scores from the initial and final surveys for the variables concerning teacher behaviors. Table 2 presents means and standard deviations obtained on the summed indicator scores from the initial and final surveys for the variables concerning student outcomes.

Table 1
Means and Standard Deviations for Initial and Final Responses to the Eruditio Survey for Variables Concerning Changes in Teacher Behaviors Regarding Using Computers

	INITIAL SURVEY			FINAL SURVEY		
Indicator	Mean	SD	N	Mean	SD	N
Instructional use	2.60	1.32	84	2.68	.90	91
Personal use	1.28	1.01	85	2.18	.74	91
Desire to use	4.73	.35	85	4.48	.45	91
Ability to use	3.18	.85	85	3.89	.69	91
Comfort using	4.29	.57	85	3.98	.69	91
Experience using	3.00	.84	85	3.78	.74	91
Desire to reach broader audience about using	3.25	.92	85	3.63	.93	91
Ability to reach broader audience about using	3.41	.80	85	3.75	.88	91
Comfort reaching broader audience about Using	3.28	.86	85	3.60	.93	91
Experience reaching broader audience about Using	2.86	.92	85	3.16	.99	91
Frequency of student input into instruction	3.53	1.02	78	3.47	1.11	91
Effectiveness of student input into instruction	3.73	1.04	78	3.90	1.01	91

Table 2
Means and Standard Deviations for Initial and Final Responses to the Eruditio Survey for Variables Concerning Changes in Student Outcomes

	INITIAL SURVEY			FINAL SURVEY		
Indicator	Mean	SD	N	Mean	SD	N
Frequency of computer use for communication	.30	.51	85	.71	.62	91
Frequency of involvement with projects/presentations	3.39	.80	84	3.15	.82	91
Effectiveness of involvement with projects/presentations	3.54	.80	84	3.54	.83	91
Frequency of computer use for classwork	2.90	1.13	77	3.20	1.09	91
Effectiveness of computer use for classwork	3.51	1.20	77	3.83	1.06	91
Frequency of assuming leadership roles	2.63	.97	78	2.73	1.02	91
Effectiveness of assuming leadership roles	2.93	1.07	78	3.19	1.06	91

To address part one of the first research question (participation in the Eruditio project will result in an increase in teachers' abilities to use and actual use of computers), a repeated measures ANOVA was implemented to examine the relationship between the responses to the initial and final survey scores on the following indicators: instructional use of computers, personal use of computers, ability to use computers, experience using computers, ability to reach a broader audience about using computers, and experience reaching a broader audience about using computers. Examples of items to which the teachers responded include: indicating how often they use computers during instruction with students (not materials presentation); rating their ability to use computers in general, word processors, spreadsheets, etc.; rating their ability and experience training others and participating in discussions about technology; and indicating how frequently they use the Internet, email, Telnet, File Transfer Protocol (FTP), and the World Wide Web. The ANOVA's on all six of these indicators were statistically significant (see Table 3).

Table 3
Results of Repeated Measures ANOVA's for Part One (increase in teachers' abilities to use and actual use of computers) of the First Research Question Regarding Positive Changes in

Teacher Behaviors

Indicator	F	df	p	partial eta²
Instructional use	27.74	1, 83	<.001	.25
Personal use	93.71	1, 84	<.001	.53
Ability to use	102.12	1, 84	<.001	.55
Experience using	127.87	1, 84	<.001	.60
Ability to reach broader audience about using	16.48	1, 84	<.001	.16
Experience reaching broader audience about using	10.74	1, 84	.002	.11

To address part two of the first research question (participation in the Eruditio project will result in a positive increase in teachers' perceptions [comfort with and desire to use] of using computers), repeated measures ANOVA's were implemented to examine the relationship between the responses to the initial and final survey scores on the following indicators: desire to use computers, comfort using computers, desire to reach a broader audience about using computers, and comfort reaching a broader audience about using computers. These questions include asking teachers to rate their desire to use and comfort using computers, word processors, etc., as well as their desire to train and comfort training others, participating in discussions about technology, etc. The ANOVA's on indicators addressing the desire to use computers, comfort in using computers, and desire to reach a broader audience about using computers) were statistically significant (see Table 4).

Table 4
Results of Repeated Measures ANOVA's for Part Two (increase in teachers' perceptions of using computers) of the First Research Question Regarding Positive Changes in Teacher Behaviors

Indicator	F	df	p	partial eta²
Desire to use	25.82	1, 84	<.001	.24
Comfort using	102.20	1, 84	<.001	.55
Desire to reach broader audience about using	56.76	1, 84	<.001	.40
Comfort reaching broader audience about using	12.53	1, 84	=.001	.13

To address part three of the first research question (participation in the Eruditio project will result in an increase in teachers' reliance on student input into curriculum and instruction), a repeated measures ANOVA was implemented to examine the relationship between the responses to the initial and final survey scores on the following indicators: frequency of student input into instruction and effectiveness of student input into instruction. Teachers were asked to respond to questions concerning how often they incorporate student input into class management and curriculum development as well as how successful they feel these efforts are. The results of the ANOVA's were not significant (F (1, 77) = 0.30, p = .583, partial ?2 = .00 and F (1, 77) = 1.03, p = .307, partial ?2 = .01, respectively).

To address part one of the second research question (participation in the Eruditio project will result in an increase in students' frequency of computer use as well as active involvement in the classroom), a repeated measures ANOVA was implemented to examine the relationship between the responses to the initial and final survey scores on the following indicators: frequency of computer use for communication, frequency of involvement with projects/presentations, frequency of computer use for classwork, and frequency of assuming leadership roles. Questions included indicating how often students: use email, Telnet, the World Wide Web, and FTP at school; do individual projects, group

projects, presentations, etc.; use computers for research and to prepare assignments; participate in evaluation of classwork; and lead class discussions. Only the result of the first ANOVA (frequency of computer use for communication) was statistically significant (see Table 5).

Table 5
Results of Repeated Measures ANOVA's for Part One (increase in students' frequency of computer use and involvement in the classroom) of the Second Research Question Regarding Improvements in Student Outcomes

Indicator	F	df	p	partial eta²
Frequency of computer use for communication	26.87	1, 84	<.001	.24
Frequency of involvement with projects/presentations	5.48	1, 83	=.022	.06
Frequency of computer use for classwork	4.05	1, 76	=.048	.05
Frequency of assuming leadership roles	0.18	1, 77	=.672	.00

To address part two of the second research question (participation in the Eruditio project will result in an increase in students' effective use of computers as well as active involvement in the classroom), a repeated measures ANOVA was implemented to examine the relationship between the responses to the initial and final survey scores on the following indicators: effectiveness of involvement with projects/presentations, effectiveness of computer use for classwork, and effectiveness of assuming leadership roles. These questions are similar in scope to the questions discussed in the prior paragraph, but deal with the effectiveness rather than frequency of student behaviors. The results of the ANOVA's were not significant (F (1, 83) = 0.03, p = .861, partial ?2= .00; F (1, 76) = 4.85, p = .031, partial ?2= .06; and F (1, 77) = 2.98, p = .088, partial ?2= .04 respectively).

Discussion

The results of the data analyses have demonstrated multiple areas of positive change in teacher behaviors as a result of the training provided through the Eruditio project. Eight of the twelve indicators of changes in teacher behaviors showed statistically significant, positive change: indicating that project participation, on average, resulted in positive outcomes for teachers involved. Teachers reported using computers more frequently for instruction as well as personal use. They also reported an increase in their ability to use computers as well as to reach out to others about computer use. Two areas of teacher behaviors actually showed statistically significant decreases: desire to use computers and comfort in using computers. The decreases were small in magnitude: dropping 0.25 and 0.31, respectively, and still resulted in post-training levels higher than would be expected in the general population. These decreases are not particularly surprising considering that project participants were a self-nominated group with seemingly higher than average desire to and comfort in using computers.

Concerted effort was made to include in the Eruditio project a number of aspects of teacher training proven to be successful in similar, previous projects: most importantly, peer mentoring; cooperative learning; a constructivist approach, including integration of technology into the curriculum; and collaboration with institutions of higher learning. Hence, the positive outcomes reported in this paper fortify the existing literature base by reaffirming the successful results seen in other projects in which similar elements were included. However, these individual elements were not measured as part of the Eruditio project evaluation. Further research might attempt to delineate which of these factors plays more or less prominent roles in the success of such programs.

Indicators of changes in student outcomes did not fare as well as the majority of the teacher outcomes: all but one of the seven student behavior indicators showed no statistically significant change. This might be an artifact of how indicators were defined and constructed as well as how data was collected (i.e., ratings of teachers' perceptions). The one indicator that did show positive change dealt with students' frequency of computer use for communication in the classroom. Whereas the majority of the remaining indicators dealt with the format of instruction/instructional practices (e.g., frequency and effectiveness of group work vs. individual work, student input into evaluation, etc.): effectively areas in which the Eruditio project was not designed to impact. In addition, information related to student outcomes was requested of and reported by teachers; students themselves may have had differing opinions and/or additional information to share. Finally, as discussed in the introduction, there are a number of advantages realized by students when technology is incorporated into the curriculum. Teachers were the focus of this project and its evaluation; however, more detailed investigation of student benefits is needed.

In closing, the concepts underlying the Eruditio project have been shown to effect positive results in teacher behavior. Elements of the project should prove beneficial for additional groups of participants and/or for implementation in other parts of the country. Although the project demonstrated positive outcomes for participants, it also is important to highlight the need to provide continuous, ongoing training. The purpose of ongoing training is threefold: first, to maintain the benefits of initial training through "refresher" sessions; to maintain the peer network established during the project; and, in light of the fact that the Internet (and technology in general) is/are rapidly and constantly changing, to keep educators on the cutting edge of the use of technology.

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