

# Bringing Classroom Diversity to the Campus: Technology as a Tool for Linking Pre-Service Teachers to Diverse Classrooms at a Distance

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**Abstract:** Field experiences are a key means to prepare future teachers for the diversity and complexity of today's classrooms, but some colleges of education lack ready access to diverse school settings. In a 3-year initiative, part of a Preparing Tomorrow's Teachers to use Technology (PT3) implementation project, Internet-based video conferencing technology was used to support pre-service teachers' observations of and interactions with diverse P-12 classrooms at a distance. Using this new technology, future teachers were able to learn about and come to better understand diverse classroom settings unavailable to them locally, thereby enhancing their preparation to become teachers. Results showed that pre-service teachers' knowledge of diversity and the use of technology grew as a result of this experience. Pros and cons of this approach were identified, and lessons learned were translated into guidelines for others who might wish to pursue the same approach. This technology offers promise as one way to expand the options for linking students in teacher preparation programs with teachers and students in diverse P-12 settings.

## Introduction

Teacher preparation programs are faced with a variety of challenges. Over the past two decades, a number of national reports have emphasized the need to improve teacher preparation (Carnegie Forum, 1986; Holmes Group, 1986; Moursand & Bielfeldt, 1999; National Commission on Teaching and America's Future, 1996). Today, programs to prepare future teachers must meet national and state standards with regard to both content and pedagogy in an era when there is increased emphasis on performance. Teacher preparation programs must also help pre-service teachers learn to use technology and develop their understanding of diversity and multiculturalism (NCATE, 2001). Meeting these challenges is increasingly difficult and may require new approaches.

Field experiences have been identified as a key means to better prepare teachers for the diversity and complexity of today's classrooms (Goodlad, 1990). While field experiences are generally recognized as critically important, many colleges of education, particularly those in rural areas, have difficulty placing students in field settings that provide for needed experiences, for example, with diverse student populations. Distance education technologies offer capabilities that can be used to provide a form of these critically important experiences for pre-service teachers when appropriate field sites are not in close proximity. Purdue University has initiated an innovative project in the use of technology-enabled field experiences, part of a Preparing Tomorrow's Teachers to use Technology (PT3) implementation grant, to address key components of its teacher preparation program including understanding of classrooms and diversity as well as technology integration.

Distance education technologies, particularly those that support video conferencing, have the potential to be of significant value. Using video conferencing technologies, prospective teachers can not only observe but also interact with P-12 students and teachers from a distance. The concept of using live video for classroom observations is not new. Reports of the use of closed circuit television for observation of classrooms in teacher education programs date back as far as the 1960s (Abel, 1960). In the 1980s, Iowa State University's Teachers on Television program was a relatively large-scale effort which showed that the observation skills of pre-service elementary teachers could be improved by observational practice using microwave-based video connections to public school classrooms (Hoy & Merkley, 1989). While successful, these older video technologies were expensive as well as difficult to set up and maintain. As a result, they were never widely implemented. Today's Internet-based video conferencing technologies offer a much more flexible and cost-effective option for observation of and interaction with school-aged learners at school sites that are remote from the university campus. Good quality group-to-group or individual-to-individual video conferencing can be accomplished over the Internet with off-the-shelf equipment, and any two sites with reasonably fast Internet connections can engage in this type of video conferencing. As a result, researchers and teacher educators are beginning to explore this technology.

Recent literature on the applications of video conferencing in education has focused on uses such as virtual field trips (LeBlanc, 2002; Pachnowski, 2002) and supervision of practicum students at a distance (Pemberton, Tyler-Wood, Pérez Cereijo, Rademacher, & Mortensen, 2001). While a few authors have reported on the use of video conferencing as a tool for remote field experiences (Edens, 2001; Howland & Wedman, 2003; O'Connor, 2003; Phillion, Johnson, & Lehman, 2003-04), this application of the technology has been relatively little explored. This paper reports on a 3-year implementation project, part of P3T3: Purdue Program for Preparing Tomorrow's Teachers to use Technology, which investigated the use of video conferencing as a tool for enhancing teacher education by providing opportunities for pre-service teachers and classes to link with P-12 students, teachers, and classrooms in diverse settings.

## **Background**

Purdue's P3T3 project is part of the U. S. Department of Education's Preparing Tomorrow's Teachers to use Technology initiative, a nationwide effort designed to ensure that future teachers are adequately prepared to use technology for teaching and learning. Purdue's project is a collaboration involving several partners. The School of Education, which plays the primary but not exclusive role in teacher preparation on the campus, is the lead organization. At Purdue, the Schools of Science and Liberal Arts, which provide coursework for teacher education students and support secondary teacher education majors in various disciplines, are partners as is the campus-wide Information Technology at Purdue (ITaP) group. Both Apple and Intel are for-profit corporate partners which have provided both equipment and training support. Partners from the non-profit sector include: the North Central Regional Technology in Education Consortium (NCRTEC), the Center for Interactive Learning and Collaboration (CILC), and the Indiana Department of Education. Finally, four Indiana school districts are partners: School City of East Chicago, Crawfordsville Community Schools, Lafayette School Corporation, and Lawrence Township Schools of Indianapolis. Two of these districts, East Chicago and Lawrence Township of Indianapolis, have much more ethnically and socio-economically diverse student bodies than most of the schools in immediate proximity to the Purdue campus. Many of the distant field experiences described in this paper have taken place in partnership with these districts.

The goals of Purdue's P3T3 project are to (1) prepare pre-service teachers to demonstrate fundamental technology competencies, using technology as a tool for teaching/learning, personal productivity, communication, and reflection on their teaching, and (2) prepare teacher education faculty to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use themselves. The project is meeting its goals via three complementary components: (a) faculty development and implementation of technology experiences in teacher preparation courses, (b) development of an electronic portfolio system for all pre-service teachers, and (c) the creation of rich and diverse field experiences enabled and enhanced through the use of technology. This paper focuses on the latter, although it also illustrates an example of the integration of technology in a teacher preparation course.

Two types of video conferencing have been used to support our efforts to create diverse field experiences for students using technology. At the outset of the project, we expected to exclusively use an intrastate fiber optic video network called Vision Athena (<http://www.visionathena.org>), managed by the Center for Interactive Learning and Collaboration, a partner in the P3T3 project. While we have used that network on a limited basis to link to some of our partner schools, IP-based video conferencing equipment from Polycom (<http://www.polycom.com>) emerged during the project as a better way to meet most of our needs. This technology supports good quality video and audio over the Internet, is relatively affordable, and is very flexible because a standard H.323 Internet video conferencing connection can be established between any two locations with access to a reasonably fast (128 Kbps or better) connection. Special distance education rooms or video studios are not needed; connections can be established from classroom to classroom.

We currently use two types of Polycom video conferencing equipment. Room-to-room video conferencing is supported by Viewstation SP (point-to-point) or Viewstation FX (multipoint) units. These compact units have an integrated camera with panning and zooming capability that can be attached to any available video monitor and plugged into an Ethernet jack for Internet connectivity. Educational prices start at about \$2,500 for the Viewstation SP. The Viewstation FX unit, which can connect up to 4 sites, is about \$7500. For person-to-person or small-group-to-small-group connectivity, we use the Polycom ViaVideo computer-based desktop video conferencing unit, which operates in conjunction with a Windows PC. While the smaller ViaVideo camera is of lesser quality and lacks the panning and zooming capability of the larger Viewstation units, this inexpensive (about \$400) unit adds the exciting capability for application sharing during video conferencing. While the costs of these video conferencing units are not trivial, they are much below video conferencing costs of just a decade ago, and the costs must be weighed against the savings in travel time and expense that can be realized from the use of video conferencing.

Several models of interaction between teacher education candidates and P-12 classrooms have been explored. Several faculty members in the School of Education have used video conferencing to provide relatively short-term experiences (usually one to three video interactions) for their classes of prospective teachers. For example, one faculty member in Consumer and Family Science Education had her class spend a class period observing a pre-school, housed in a high school in an urban center in the state, to learn more about its operation. A faculty member in Agriculture Education had his teacher education students spend a class period making structured observations of a high school classroom to learn about teaching techniques and classroom management. A faculty member in Educational Technology, with the assistance of an advanced graduate student, developed several projects with partner elementary schools in which his university students developed and then used instructional materials with the elementary students. The university students led a series of video conferencing sessions to teach lessons with their materials and involve the elementary students (see O'Connor, 2003; Phillion, Johnson, & Lehman, 2003-04).

The longest running pilot project involving the use of video conferencing to connect pre-service teachers with diverse P-12 settings has now spanned over three years. In this pilot project, which is the focus of this paper, an introductory teacher education class at the university linked with an elementary school classroom in a diverse, urban region of the state. This project involved a more sustained use of the video conferencing with pre-service teachers connecting to an elementary classroom once per week throughout most of a semester. A video program describing this pilot project was produced by WHRO-TV and Soundprint Media for the *PT3 Now!* video series and can be viewed online at: <http://www.pt3now.org/207.php>.

This pilot project was implemented in order to link learning about technology with learning about classrooms, diversity, and multiculturalism. While pre-service teachers often feel there is no need to understand diverse populations of students because they plan to teach in predominantly white and rural areas after graduation (Yeo, 1999), demographics of schools are changing throughout the country. Prospective teachers must be exposed to the diverse classrooms they are likely to encounter in the future. In this project, pre-service teachers enrolled in the first course in Purdue's teacher education program linked with a teacher and students in a grade two or three bilingual class in a diverse inner city school in East Chicago, one of the poorest and most culturally diverse districts in the state of Indiana.

Once per week throughout most the semester, the teacher education class connected with the elementary classroom for 1-2 hours. Initially, the pre-service teachers used the video conferencing to focus on classroom observations under the guidance of the instructor. This activity helped the pre-service teachers, who were just beginning their teacher education programs, to gain a perspective on classrooms from a different vantage point. Because the instructor observed alongside the students, there were opportunities for rich discussions that emerged out of the shared observational context. As the semester progressed, sessions became increasingly interactive. Eventually, the future teachers actually conducted lessons for the elementary students, designed to supplement the elementary teacher's curriculum, via the video conferencing. Thus, the prospective teachers got the experience of working with diverse students using a cutting-edge technology that promises to be more widespread by the time they become certified teachers and move into their own classrooms.

During each semester that the pilot project was implemented, the pre-service teachers started the semester by becoming acquainted with the technology. They learned to connect to the remote site, operate the remote controls for the cameras both at the Purdue site and the school site, and develop mechanisms to facilitate communication. The pre-service teachers practiced with the equipment by splitting into two groups and conducting a practice video conferencing session between two local classrooms. A checklist of procedures was developed to help the pre-service teachers learn how to connect to the school site. Prior to beginning the actual video conferencing field experiences, the university class made a site visit to the participating school. During this trip, the pre-service teachers spent the day touring the school; meeting staff, teachers and students; and interacting with the elementary students involved in the project. This visit allowed the pre-service teachers to gain first-hand knowledge of the school and the students, which we believe helped to overcome some of the impersonal nature of remote connection.

Following the site visit, the virtual field experiences began and continued weekly through the remainder of the semester. Initially, pre-service teachers spent time observing the classroom and getting oriented to classroom activities. During one semester, the first session was spent on introductions. Students in the elementary class and pre-service teachers brought in baby pictures and made riddles about "Who am I?" Pre-service teachers prepared Powerpoint presentations of their riddles to share. Some riddles were done in English and some in Spanish for the bilingual classroom.

A typical interactive session began with the classroom teacher teaching one of her usual lessons. The pre-service teachers then took turns, individually or in small groups, directly teaching mini-lessons to the students. These activities were designed to reinforce what the teacher was teaching in the class or enrich the curriculum. Over the life of this pilot project, pre-service teachers have had the opportunity to engage in a variety of activities, including teaching lessons on equal and unequal fractions using everyday objects, colorful graphs, and diagrams and charts; reading stories and providing follow up questions; researching information about Benjamin Franklin and presenting it to students in the form of a skit; and, discussing the 9/11 World Trade Center disaster.

In the recent semester, the cooperating elementary teacher was preparing to teach in Japan and decided to use Japan as a year-long theme. Purdue pre-service teachers were invited to participate by preparing activities related to Japan. The students, Purdue pre-service teachers, and the classroom teacher brainstormed questions about Japan. The teacher then organized these questions into topic areas including: geography, school life, food, daily activities, wildlife and art/drama/literature. Purdue pre-service teachers then worked in groups of three to prepare lessons about these topics. For example, the school life group wrote a book. The food group did a lesson on preparing sushi via the video conferencing, while the teacher did a similar activity in her class. Thus, a variety of enrichment lessons were created, adding to the teacher's curriculum while giving the pre-service teachers a chance to learn about and work with diverse elementary students. The Japan project took place over the entire semester and was deemed by the teacher, who had done videoconferencing several times, and the faculty member who had also done it several times, to be the most successful format for interaction over the course of the pilot project.

## Evaluation

In order to understand the learning of the pre-service teachers about diversity issues and the use of technology, both qualitative and quantitative methodologies were employed as part of the evaluation of the pilot project. Quantitative data were collected by means of short online surveys completed by the pre-service teachers in the pilot study class. Data for this paper were drawn from the fall 2002 and spring 2003 surveys administered at the end of the semester. The online surveys contained both Likert-type and open-ended questions that probed pre-service teachers' attitudes toward the technology and class experience.

Qualitative data were drawn from the open-ended responses to survey items and from pre-service teachers' journals. The contents of the journals were analyzed for themes related to diversity and technology use. Student journals and questionnaires were reviewed by the instructor (the second author of the paper) and by the P3T3 project coordinator (the lead author of the paper). Outcomes related to diversity and technology are discussed below. In addition to these sources of information, regular observations were made of the video conferencing sessions, and these observations contributed to the overall assessment of the impact of the project.

## Outcomes

Although the pre-service teachers had very little familiarity with video conferencing at the outset of the class, we found that they quickly adjusted to it. At the end of the class, mean responses to all of the Likert-type survey items fell on the positive side of the scale; most clustered near a response of "agree" (see Table 1). The pre-service teachers tended to agree that they were comfortable with the technology, found it easy to use, learned how to use it from the class, and found it to be of value to the class. They also tended to agree that the experience made them more comfortable in their ability to use technology for teaching and learning and in their ability to understand and work with diverse learners. One pre-service teacher commented, "I've learned that technology can do a lot of good things in education." Our observations of the P-12 class suggested that the P-12 students also became comfortable with the technology fairly quickly. Students quickly got over the novelty of being on camera, and, with prompting from the teacher, they learned to raise their hands, speak up, and otherwise follow protocols that facilitated communication with their distant "Purdue friends."

**Table 1.**  
**Summary of Pre-Service Teachers' Responses to Likert-type Survey Items**

Likert-type Survey Item	Fall 2002 Mean (n=21)	Spring 2003 Mean (n=21)
By the end of the class, I felt comfortable with video conferencing equipment that we used.	3.90	3.71
The video conferencing in this class was easy to use.	4.00	4.00
I learned how to use video conferencing in education from this class.	3.95	3.67
I believe that the use of video conferencing was a valuable addition to this class.	3.95	3.33
Because of the experience in this class, I feel more comfortable in my ability to use technology for teaching and learning.	3.90	3.62
Because of the experience in this class, I feel more comfortable in my ability to understand and teach diverse learners.	3.90	4.14

Note: means on scale of 5 = strongly agree, 4 = agree, 3 = undecided, 2 = disagree, 1 = strongly disagree

The pre-service teachers began to see the technology as a tool that could be used for teaching and their own and others' learning, personal productivity, and communication. While these beginning teacher education majors came into the course as unskilled observers, through the guidance of a faculty member who observed

alongside them via the video conferencing, they became better observers themselves. One pre-service teacher commented, "We got a chance to see a classroom without actually being there." The traditional model for early field experience, at least as implemented in this university course, involves sending all of the pre-service teachers into classrooms for one to two hours of observation per week. The pre-services teachers all visit different classrooms, and they come together the following week to discuss their observations. While certainly useful, this approach lacks a shared context. Different pre-service teachers observe different classrooms and activities, and the instructor has no idea what most of them have seen. The shared observational experience of the distance field experience, on the other hand, led to opportunities for richer class discussions. Because the instructor and all of the pre-service teachers observed the same teacher, students, and classroom events, they were able to discuss their observations from a common ground.

Pre-service teachers' journals and questionnaires indicated that their understanding of diversity issues and how to teach "other people's children" (Delpit, 1995) also grew during the project. One pre-service teacher commented, "I also think that being able to see a more diverse classroom than the ones close by was a big advantage for us because it gave us something to relate our multicultural studies to." Diversity was in every interaction, although subtly, and in sometimes unexpected ways. Pre-service teachers thought the classroom teacher would teach differently because she had diverse students. In interactions with the teacher and students and in interviews with the teacher, they have found that the teacher did not "water down the curriculum, had high expectations, taught in an integrated style, and built on the students' prior experiences". They also began to question their assumptions and beliefs about teaching and learning of diverse groups of students. This is an important aspect of preparing pre-service teachers to understand diverse populations (Gay, 2000; Ladson-Billings, 1994, 2001). One pre-service teacher commented, "I've learned not to be afraid of teaching students in the more run down communities and that they're not as scary as I had first imagined."

Although there were a number of indicators of success, there were also problems and issues. The technology, while generally working well, did have occasional problems. One pre-service teacher commented, "Technology is not perfect. We weren't able to connect one time and had trouble connecting another time. It can be hard to see..." Technical problems were more frequent during the spring of 2003, and this probably contributed to the somewhat low mean response to the item, "I believe that the use of video conferencing was a valuable addition to this class" (see Table 1). A number of the pre-service teachers were also put off by the lack of face-to-face contact with the teacher and her students. One pre-service teacher commented, "I feel that we have not gotten an experience that we would have in the other class that actually went into the classrooms. I feel that we have been cheated..." However, a number of pre-service teachers shared the sentiment expressed by one who said, "At first I was opposed to the idea, but now I kind of like the experiences I had." A similar reaction was expressed by another who wrote, "At first, I was very skeptical. However, it turned out to be a very good experience."

## **Discussion**

When working with any new medium of communication, there are inevitable difficulties. The first hurdle to overcome in this pilot project was simply getting the technology working at both sites. For IP-based video conferencing, a significant initial barrier is school Internet firewalls. Because of information security concerns, most schools are protected by an Internet firewall. While keeping people out of the internal network, a firewall can be configured to allow selected outside connections. When trying to set up this access, we ran into a number of difficulties. Purdue technical support staff worked with the technical support staff at the school to "punch a hole" in the school's Internet firewall for the video conferencing. Once done, everything worked fairly well until network changes caused problems that had to be corrected. If you are contemplating trying this approach, be sure to allow for plenty of lead time to get the technology working, and do one or more test sessions prior to the first video conferencing session.

Participants, both Purdue pre-service teachers and P-12 students, had to spend time getting acclimated to the system of communication. This process was not difficult, but it was critically important. The university students needed to practice using the system to help them get a feel for the communication abilities, and the P-12 teacher and students needed to develop procedures (e.g., raising hands, speaking loudly, addressing the

camera) to facilitate routine communication. For a successful experience, develop conventions to facilitate communication, such as having name signs and using signals to denote when students at the remote site are supposed to do something.

In this pilot project, pre-service teachers learned to see technology as a tool that enabled them to communicate across distance, and with students they may have had little experience of in the past. One pre-service teacher commented, "I feel that it was a good opportunity for us to receive a chance to see a school that is very diverse. We received an experience that others have not." Just learning to use the technology itself was a benefit for many of the pre-service teachers. One commented, "I have learned about the equipment used in such a process so I would feel comfortable participating in something like this in the future!" If you decide to try to use video conferencing in this way, kill two birds with one stone by helping the students understand how the technology can be used in the classroom.

The technology is good, but it has limitations. Sometimes we were unable to establish a connection due to technical problems of one kind or another. In addition, IP-based video conferencing connections are susceptible to problems as a result of limited bandwidth or network congestion. Sometimes the Internet-based video conferencing connection is "choppy." When Internet packets are "dropped" as a result of network traffic, this can result in the video freezing and the audio breaking up. Even when working perfectly, the picture on the screen, while not bad, could be clearer. Effective observation often means noting facial expressions and body gestures not easily discerned by viewing a video monitor. Pre-service teachers reported that they had difficulty judging whether the P-12 students at a distance understood when a lesson was being presented. Audio was also problematic at times. While the teacher's voice comes through clearly most of the time, the children's voices are less clear. Furthermore, background room noise can create interference. We have found that having the teacher work with the students to speak more loudly and clearly helps.

The main issue for the pre-service teachers was that they were not in a "real" classroom with "real" students. Some students, at least initially, felt a loss at this mode of interaction. Clearly, this kind of distant or virtual field experience should not be viewed as a substitute for traditional field experiences in real classrooms. Pre-service teachers need real field experiences. However, by the end of the course, most found value in the distant field experience. One pre-service teacher captured this sentiment by commenting, "It was a really good experience. I was somewhat upset at the beginning that I wasn't going to be able to go to the classroom, but I feel I learned just as much, if not more, than I would if I had to be in a class." If you try this approach in your teacher education program, be sure that your pre-service teachers do experience genuine field experiences, and stress to them that this is a supplemental approach that has certain advantages and disadvantages.

Our pilot project suggests that technology-enabled field experiences provide a viable alternative for some types of student observations and for interactions with P-12 teachers and students. While certainly not a replacement for traditional field experiences, video conferencing over the Internet offers a promising new tool for teacher preparation programs. It provides one avenue for offering field experiences and for linking with diverse P-12 sites in a way that provides for flexibility and emphasizes integration of technology. It is one new tool for expanding the options for linking students in teacher preparation programs with P-12 teachers and students to enhance their preparation with respect to both technology integration and the ability to understand and work with diverse students.

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