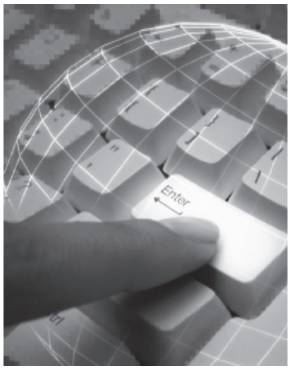

Technology and Teacher Preparation in Exemplary Institutions: 1994 to 2003

Mark Hofer

Abstract

In a 1994 study commissioned by the Congressional Office of Technology Assessment, Mergendoller, Johnston, Rockman, & Willis (1994) examined four exemplary institutions to identify their approaches to integrating technology into teacher education. A decade later, the field would benefit from a comparison of current approaches of infusing technology into teacher education to the 1994 findings. This study examines the approaches of the first seven teacher education programs to receive the ISTE NETS Distinguished Achievement Award. Current approaches to the process are outlined, including the identification of the key factors impacting their implementation. A comparison of the 1994 and the present study reveals that the systematic coordination of experiences in the teacher preparation program, a unifying theme throughout the program, and a shared vision of technology and teaching are instrumental and may help guide future efforts of technology integration into teacher preparation.

A decade ago, in a study commissioned by the Congressional Office of Technology Assessment, Mergendoller, Johnston, Rockman, & Willis (1994) examined four exemplary institutions to identify their approaches to integrating technology into teacher education. The four teacher preparation programs were selected based on their exemplary utilization of state-of-the-art technology. Through a "snowball sampling" approach, 32 potential sites were identified. Of this sample, four teacher preparation programs and four inservice teacher preparation programs were selected in conjunction with the U.S. Office of Technology Assessment for site visits and evaluation. In comparing the programs at the University of Northern Iowa, the University of Wyoming, the University of Virginia, and Vanderbilt University, eight keys to implementing technology were identified:

- **Leadership**—particularly, the central role of the dean in supporting the initiative
- **The Long March**—the process of using small, incremental steps in the attainment of the necessary technology infrastructure
- **Norms, Expectations, and Philosophy**—the focus on encouragement, rather than on mandating use of technology
- **User Support**—the importance of one-on-one support and mentoring
- **Distributed Expertise**—the search for outside expertise and funding to support process
- **Technology Integration**—the focus of educational technology as an integral part of the teacher preparation process, not just a course requirement
- **Technology Rich Classroom Environments**—the challenge of placing students in effective field experiences with technology
- **Time and Money**—the extended time and resources necessary to implement the process (Mergendoller et al., 1994)

In studying seven exemplary teacher education programs in 2003, many issues remain the same.

Ten years after this landmark study, the field would benefit from an exploration of how award-winning teacher education programs prepare preservice teachers to use technology. This study is an attempt to investigate the process of integrating technology into teacher preparation in the first seven teacher preparation programs to be awarded the ISTE NETS Distinguished Achievement Award. Through a triangulation of evidence from program documentation and course syllabi, an instructor questionnaire, and interview data, a typology of implementation of the ISTE standards is outlined, including a discussion of key factors in implementation.

The following two questions frame this study:

1. How are the ISTE technology standards addressed throughout the teacher education program at each institution?
2. What barriers, incentives, and systemic support influence the integration of technology throughout the teacher education program?

Background

To encourage the incorporation of technology in teacher preparation, in 1997 the National Council for Accreditation for Teacher Education (NCATE) adopted the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) for preparing preservice teachers to use technology. The NCATE standards provide the framework by which 600 of the nearly 1,300 teacher preparation programs in the United States are accredited, and more than two-thirds of all new teachers certified are endorsed (Darling-Hammond, 2001). However, because the ISTE standards are meant to be guidelines and not specific directives, a variety of strategies may be used by teacher education programs to meet them.

Initial efforts to integrate technology into teacher preparation typically focus on a single class on educational technology. According to a study of 344 teacher education programs conducted by Betrus (2002), 275 (or 79.9%) of the programs surveyed reported that they offered an educational technology course as a part of the teacher preparation program. Many of these courses focus on personal and professional productivity (Betrus, 2002; Mehlinger & Powers, 2002), while others emphasize the integration of technology into classroom teaching (Francis-Pelton et al., 2000; Hill, 1999; Whitaker & Hofer, 2002) Others argue that increasing preservice teachers' technology skills and their ability to use them in the classroom requires the modeling of technology in teaching methods courses (Adamy, 1999; Beisser, 1999; Byrum & Cashman, 1993; Handler & Marshall, 1995; Wetzel, 1993). This integrated approach calls for technology to be incorporated in teaching methods courses, so that teacher candidates see the technology modeled in the unique context of their content area.

While the integrated approach moves towards the modeling in teaching methods courses and use of technology throughout the teacher preparation sequence discussed above, Mehlinger and Powers (2002) describe the next step in this evolution, referred to here as the pervasive approach. This approach is distinguished from the integrated approach in that technology is integrated not only in a few selected courses. Rather, "with a fully integrated approach, teacher education students experience different technologies everywhere in their programs" (p. 103). Not only would technology be incorporated, where appropriate, into all aspects of a given course, it would be incorporated into all aspects of the entire program, including field placements and student teaching. This is the type of technology integration organizations such as ISTE and NCATE are trying to encourage with the NETS standards. Although there is probably no truly integrated program in the United States, the seven ISTE NETS Distinguished Achievement Award winners are current exemplars.

Methodology

Sample

In 2002, ISTE created the ISTE NETS Distinguished Achievement Award to highlight teacher education programs for their exemplary incorporation of the ISTE NETS standards into teacher preparation. The ISTE Web site (http://www.iste.org) describes the Distinguished Achievement Award as follows:

> The Distinguished Achievement Award recognizes institutions that have exhibited exemplary models of integration of the National Educational Technology Standards for Teachers (NETS•T) into their teacher education programs. This might include integration of the NETS•T standards into one or more programs or one particular feature of a program that exemplifies the NETS•T standards.

The first six recipients of this award—Arizona State University West; Hope College; Ohio State University, Mansfield; University of Texas, Austin; University of Virginia; and Wake Forest University—were selected in February, 2002. Valley City State University was selected in May, 2002. At least two faculty members were selected on the recommendation of the program coordinator from each program to form the sample for the study. This sample was chosen to illustrate the approaches of "best practice" programs' implementation of the technology standards and how they have integrated the ISTE standards into their programs.

Data Collection and Analysis

The purpose of this study was to create a snapshot of the seven programs' approaches to preparing teachers to use technology. To this end, a variety of data were collected in order to understand each approach and to compare across programs. An examination of the application data submitted by each program for the ISTE NETS Distinguished Achievement Award and related course syllabi, interviews with the program coordinator and other faculty members from each program, and questionnaires designed to define what technology and teaching skills and concepts are addressed in different areas of the program frame the overall approach to technology integration at each institution. Each form of data collected is discussed below.

Award Application Data

To be considered for the ISTE NETS Distinguished Achievement Award, applicants were required to document their program's approach to implementing the standards, including information on technology-integrated courses and their syllabi, a matrix demonstrating implementation of the standards, and student work samples as evidence of meeting the standards. The objective in this phase of the study was to collect basic program information and to develop a conceptual framework to compare the approaches of each of the programs (Miles & Huberman, 1994). The conceptual framework matrix was designed to identify major features of each program to frame the analysis. The documentary evidence, and later interview transcripts, were then applied to this framework to create a table comparing key features of implementing the ISTE standards. See Appendix (page 12) for the implementation matrices.

Questionnaire Data

Following the collection of the award application data, a questionnaire was sent to the technology course instructor and other faculty identified by the program coordinator from each institution. A detailed survey of skills and implementation of the ISTE standards was sent to the instructor for the technology course at each institution requiring these courses, focusing on types of hardware and software tools addressed and how teaching with technology is approached. A more general survey focusing primarily on instructional uses and course assignments relating to technology was sent to the general education faculty participants. Data from the questionnaires were summarized through descriptive statistics, analyzed for trends, and reported in aggregate form. In total, 18 questionnaires from the seven programs were returned and incorporated into the analysis.

Interview Data

Follow-up interviews provided an opportunity to gain more depth of understanding of each program's approach to technology integration and different issues they faced in implementation. The interviews focused on the context of the individual programs, the process by which technology integration had been achieved, and barriers and incentives to implementing the technology standards. The semi-structured approach to interviewing provides a common framework to make sure key issues are addressed across all the programs, while still allowing for flexibility to capture the unique context of each approach (Patton, 1990). The interviews with a total of 14 instructors from the seven programs were conducted over the telephone or in person when possible and were taped and later transcribed for analysis. The transcripts were sent to participants for any editing, deletion, or clarification they wished to make.

Findings

An examination of the data revealed a variety of approaches to the implementation of the standards in the teacher preparation programs, including the different types of courses that address one or more of the technology standards, the distribution of these types of courses in different programs, and the number of standards addressed by each course. Institutional support for the standards implementation, the organizational culture, and leadership approaches were all important factors in the success across the programs.

Programmatic Approach to Technology Integration

The teacher education programs included in the study implement the standards in a variety of courses in the teacher preparation sequence, including educational technology courses, teaching methods courses, foundational and other education courses, and field experiences. Each program employs multiple courses to address each standard. Table 1 outlines the percent of each type of course (technology, teaching methods, other education courses, and field experiences) that addresses each standard across all programs. For example, all of the technology courses, 40.7% of methods courses, 47.8% of other education courses, and 57.1% of field experiences address Standard 1.

The standards focusing on technology skills (Standards 1 and 5) are primarily emphasized in the technology courses (100% for each standard, compared with an average of 61.4% and 74.5% for all courses). Standard 5—Using Technology Skills for Productivity and Professional Practice—is more broadly addressed in the programs in practitioner courses (87% of teaching methods courses and 76.2% of field experiences) than Standard

Table 1. Percentage of Different Types of Courses Addressing Each Standard

Standard Addressed	Technology Course(s) n = 10	Methods Courses n = 53	Education Courses n = 23	Field Experience n = 22
Standard 1 Technology Operations and Concepts	100.0%	40.7%	47.8%	57.1%
Standard 2 Planning and Designing Learning Environments and Experiences	70.0%	90.7%	30.4%	66.7%
Standard 3 Teaching, Learning, and the Curriculum	80.0%	87.0%	39.1%	85.7%
Standard 4 Assessment and Evaluation	80.0%	79.6%	26.1%	71.4%
Standard 5 Productivity and Professional Practice	100.0%	87.0%	34.8%	76.2%
Standard 6 Social, Ethical, and Legal Issues	70.0%	35.2%	39.1%	66.6%
Average	**83.3%**	**70.0%**	**36.2%**	**70.6%**

1. Standard 3, emphasizing teaching with technology, is relatively evenly dealt with in technology courses, methods courses, and field experiences (80%, 87%, and 85.7%, respectively). Field experiences score high in terms of practice using technology (Standards 3 and 5) and the social, ethical, and legal issues related to technology use (Standard 6). Other education courses (foundations of education, educational psychology, etc.) are not as significant as practitioner courses in implementing the standards (average of 36.2%). Technology courses addressed all of the standards to a greater degree than any other category of classes (70% or higher for each standard, 83% overall).

Another noteworthy finding from the implementation matrix was that the programs addressed the standards in a range of courses. Table 2 shows the distribution of different types of courses addressing at least one of the ISTE standards for each program.

The number of courses addressing technology in each program ranges from eight courses at the University of Texas, Austin, to 22 courses at Wake Forest University. It is important to note that some of the programs, including the University of Texas, Austin, chose to emphasize only a part of their teacher preparation program for the ISTE NETS Distinguished Achievement Award, while others, such as Wake Forest, presented their programs as a whole. Only those courses identified specifically in the award documentation were included in the implementation matrix. This may explain some of the range in number of courses implementing the standards across programs.

All but Hope College and Wake Forest require at least one educational technology course. Ohio State University-Mansfield and the University of Virginia offer three and four technology courses, respectively. Most frequently, integration of the standards occurs in methods courses (50% of all courses, or an average of nearly eight courses per program), other education courses (21.3% of all courses), and field experiences (19.4% of all courses). Hope College and Wake Forest have substantial field experiences (field placements, internships, student teaching, etc.) that utilize technology, eight and five courses, respectively.

Single courses, rather than focusing on specific, isolated uses of technology, often address multiple ISTE standards. The number of courses, across programs, are shown with the number of standards addressed in Table 3.

Table 2. Distribution of Courses in Each Program Addressing Technology by Category

Program	Technology Course(s)	Methods Courses	Education Courses	Field Experience	Total Courses
Arizona State University West	1	9	2	1	13
Hope College	N/A	8	3	8	19
Ohio State University-Mansfield	3	9	6	2	20
University of Texas, Austin	N/A	5	3	0	8
University of Virginia	4	4	0	3	11
Valley City State University	1	9	3	2	15
Wake Forest University	1	10	6	5	22
Totals	**10**	**54**	**23**	**21**	**108**

Table 3. Single Courses Addressing Multiple Standards

Number of Standards Addressed	Number of Courses	Percentage of Courses
All Standards	23	21.3%
5 of 6 Standards	18	16.7%
4 of 6 Standards	21	19.4%
3 of 6 Standards	18	16.7%
2 of 6 Standards	14	13%
1 of 6 Standards	14	13%
Total	**108**	

There is clearly a trend towards courses addressing a variety of the ISTE standards, rather than focusing on only one or two. In fact, only 13% of courses across programs addressed only one ISTE standard. Twenty-three courses (21.3% of all courses) address all of the standards. Seventy-four percent of courses address three or more of the six standards. This tendency for courses to cover multiple standards may indicate that technology plays a significant role in the content of the courses.

Although gaining a broad picture of how programs are integrating technology into teacher preparation is valuable, it is equally important to understand how the process was undertaken. In reviewing the transcripts from the interviews, several common issues in the implementation of the standards emerged. These include the importance of institutional support and culture, the impact of incentives, and the key role of leadership.

Institutional Support

Institutional support was mentioned in many of the award application packets and interviews with instructors. This support can take many forms, but three elements were cited by study participants as most important: sufficient infrastructure, technical support, and instructional support with technology. The importance of university/college support of the campus technology infrastructure was identified by nine of the participants. Nearly all the programs reported adequate, if not excellent, computer labs, faculty computers, network access, and the opportunity to explore new software and equipment. Two programs provide a laptop computer for every student, and another sends students into their field experience with a technology kit containing a laptop computer, LCD project, flexcam digital camera, and other necessary equipment. None of the study participants expressed any concern regarding a lack of access to necessary equipment.

Technical support was also identified as a key to success by many of the participants. Although not unanimous, technical support was viewed as generally sufficient across all programs. Even those who mentioned concerns found ways to address problems they had, either formally or informally, with the help of colleagues. Wake Forest utilizes a multi-layered, university-wide support service, while Ohio State University-Mansfield noted the benefits of a small program with personal service. Although there were some complaints regarding an inability to acquire/install necessary software and equipment, for the most part the programs seem to provide at least adequate technical support for faculty.

Instructional support with technology, or support with integrating technology use in teaching, appears more mixed. Wake Forest had the benefit of a dedicated faculty position to support technology integration in teacher education; however, most reported at least some lack of instructional support. Many programs had used grant money, particularly from the Preparing Tomorrow's Teachers to Use Technology (PT^3) program, to fund training and support personnel to assist in integrating technology into classroom instruction. For the most part, however, as this grant money ran out, so too did the support. Four participants from different institutions reported significant frustration with the lack of instructional support. The majority, however, identified a community of fellow instructors who work together informally to address instructional issues.

Organizational Culture

The culture of both the college/department and larger institution also impacts the implementation process. The culture of an organization helps to define what is valued and how people spend their time (Sergiovanni, 2000). Several aspects of school culture are evident in the interviews with the participants in this study, including the focus on student needs, the value placed on innovative practice, and the importance of program reputation relative to peer institutions.

When asked why faculty members at their institution have expended the time and energy to integrate technology into their courses, almost to a person the needs of the students were cited. In some cases, it was the students pushing the faculty by incorporating technology on their own into projects. For example, at Hope College, one instructor commented,

> I think, initially, it spurred some faculty on because the students would say "Hey, we're doing this," or "Hey, could we try this?" or "Could I do my presentation in a different way, using HyperStudio or something?" The students, I would say, have been one of the biggest motivators.

Another instructor at Hope College remarked, "I've learned so much from my students it's unbelievable. Because every single year, the expectations increase; students come in more aware, and more capable than the previous group." An instructor from Valley City State University said, simply, "The students expect it." Instructors from other programs shared similar stories.

In other cases, the faculty members reported feeling that it is their job to prepare their students to be successful teachers, and that this meant, in part, being able to incorporate technology into their teaching. Asked what he thinks motivates faculty at the University of Virginia, a methods instructor stated, "I would say the main incentive would be preparing students with the tools they need to do a better job. In other words, there would be pedagogical incentives." An instructor at Wake Forest noted,

> We know that our students are doing great things with technology. So that's why we keep moving forward, because we want to be able to prepare them at a very high level, and to help our teacher candidates make a difference in the quality of instruction in schools. … It's just understood we're going to do it, because that's the right thing to do.

Incentives

In the interviews, when asked about incentives, the needs of students came up much more frequently than stipends, grants, or other form of monetary compensation. After explicit prompting in the interview, only three of the seven programs offered either monetary incentives or release time for faculty incorporating technology into their teaching. The University of Texas, Austin offers a competitive internal grant program to support work with technology and teaching. Arizona State University West offers faculty stipends for attending workshops, and Valley City State University provides stipends for faculty who create tutorials for various software applications.

Two of the seven programs stated explicitly that their college/department and/or larger institution placed a high value on innovative practice. Four other programs alluded to this without stating it directly. This commitment to innovation manifests itself in providing every student with a laptop (Wake Forest and Valley City State), the creation of an innovative pairing of the Colleges of Arts and Science and Education (University of Texas, Austin), the creation of field experiences connected to every education course (Hope College), and in other ways. This commitment to innovation across programs is evident in the willingness of faculty to, at the least, redesign—and in some cases, reinvent—their approach to preparing teachers. An instructor at Wake Forest summed up this attitude: "Faculty and department chairs feel comfortable in taking risks with new approaches and finding ways that will help them in their respective instructional needs and their programs." It was clear that this innovative mindset was simply an expectation in many of the programs.

A surprising finding regarding the culture of three of the programs relates to the organizations' view of program reputation. In all three cases, these programs saw the appropriate and innovative use of technology as a way to stand apart from peer institutions. An instructor at Wake Forest stated, "I think there's a competitive culture here. … Our upper administration at least sees us in competition with the best universities in the country, and I guess I could say we all feel that way a little bit." Another acknowledged that "they had determined on campus, from the President and a small group of people working with him, that they would choose, as a part of the university mission, to become the educational technology leaders in the state system." This vision led to the hiring of faculty with expertise in technology to help move the program forward. A faculty member from Arizona State University West echoed this commitment to technology when he reported,

> As one campus of three at Arizona State University, our college and specifically the early childhood program, wanted to stand out from others. Thus, several years ago the leadership team of the college decided to focus on technology integration as a key area.

At Hope College, one faculty member noted,

> The college strives to be the best in every endeavor. Hope has put an incredible amount of funding and on-campus expertise in equipping us with the tools and the training for exploring technology in our classrooms. There is a lot of "cross-pollination" going on across campus—humanities professors sharing what they do with the natural scientists, a professor in the natural sciences who developed his own discussion board system that is being used campus-wide, frequent upgrades in hardware and software, etc.

Leadership

Of all the variables examined affecting the implementation of the ISTE standards into these teacher education programs, the one that was most often cited and most often emphasized was leadership. Each participant interviewed was able to quickly identify at least one "champion" who pushed, prodded, or guided faculty members to see how technology could be incorporated into their teaching. In some cases this was a formal university/college/department committee. Although one program noted an authoritative stance on the part of the college administration ("It wasn't presented as, 'Well, should we do this?' It was, 'How can we make this successful?' The statement was, 'the train is leaving.'"), typically the approach was more grassroots, and led from within the college/department.

Three of the programs conducted a curriculum mapping process where the ISTE standards were aligned with particular courses to ensure that the standards were being met and not unnecessarily duplicated in different courses. In some programs, this was accomplished in faculty meetings. For the coordinator of one program, it required sending out surveys to faculty members to find out which standards they were already addressing in their courses. This effort required "dogged perseverance." It is interesting to note that, even when the process was formalized, the actual implementation of the standards was often less structured and success was not ensured. For example, a faculty member at Valley City State University reported,

> The way it's happening has been very on the fly, so to speak. How are we going to do this now that we've got it? How do we use it all? And it's been very hard to make all of that work, mostly because of a time factor or lack of it.

Although this curriculum mapping process was reported as important by many of the participants, this planning process alone is only the beginning. The length of the process of integrating technology in teacher preparation varied across programs. For some of the programs, this is a relatively new initiative. For example, in 1997, the dean of the College of Natural Sciences at the University of Texas, Austin formed a partnership with the dean of the School of Education to form the UTeach program. Each course in the program was designed from scratch. Because the design of courses occurred so recently, one instructor noted that technology was so pervasive that the ISTE standards were built into the courses as a natural component of the course content. This situation is different from programs such as Hope College and the University of Virginia, which have developed their current programs over a number of years. For example, the Curry School of Education at the University of Virginia made a commitment to integrating technology into teacher preparation in the mid-1980s, leading to multiple national awards and recognition. This long track record of successful incorporation of technology provides the benefit of the insight that comes from years of experience. On the other hand, with gradual development, courses had to be altered to incorporate new standards instead of being built around them.

In other cases it was a less formal process in which individual faculty became interested in technology and that interest spread to other faculty members. A methods faculty member from the University of Virginia suggested that the interest of individual faculty might depend, to some degree, on their field. He suggested, "Some fields don't have as much technology developed specifically for their content area."

A faculty member from Hope College looked more at the personal connection involved in getting interested in technology integration. She remarked,

> I'd say we all just "came around" as we were personally ready to think about infusing technology into our particular courses. [Our program coordinator] kept saying that she was available any time we wanted to talk about what we might be interested in exploring—and she was exceptionally supportive and not pushy about it, just clearly enthusiastic. I think [her] low-key approach has been instrumental in lowering our individual and collective level of concern and actually motivating us more rather than less over time.

Participants noted that the key factor, regardless of the person/people in charge, was the way in which they worked with their colleagues. Faculty are not easily coerced or "mandated." The participants in this study describe the champion(s) in different terms. One faculty member from Arizona State University West commented that the leaders of the initiative there "have the same beliefs that I do, that we need to enter the next century, and universities need to move forward and offer something to these students as customers. I believe that there was a personal commitment and also a professional commitment to what makes a college stand out." An instructor from Wake Forest described her view of the project coordinator: "She, from the outset I think, had in her mind that she wanted to understand what we do so that she could help us. And I really appreciate that." The common attribute of the champions of this move to integrate the ISTE standards was the personal, supportive manner in which they led their colleagues. A faculty member at the University of Virginia put it this way, "You don't really push people to start incorporating technology into their pedagogy courses. When people are ready, they will do it. But you have to have support in place."

In the programs studied, the implementation of the ISTE standards was not a top-down, authoritative directive. Rather, it was often described as a democratic process that valued the opinions of the faculty members, addressed their concerns, and always kept the focus on effective teaching and learning, and not on the technology itself.

Technology and Teacher Education: 1994 and 2003

In comparing the seven exemplary teacher education programs in 2003 to those Mergendoller et al. examined in 1994, there are certain differences. First and foremost, as described in the literature (Mehlinger & Powers, 2002), programs are beginning to put greater emphasis on technology throughout the teacher preparation program rather than emphasizing "the technology course." In particular, all seven of these programs have found ways to include technology in field experiences. Although this may still be a challenge, this increase in field-based experiences with technology stands in stark contrast to the 1994 findings. A second difference deals with leadership. Although Mergendoller et al, found that the deans were instrumental in the integration of technology, the current mode seems to be more grassroots: faculty from each program noted the support (fiscally and in terms of college/department priorities) of the dean, but the champion was, in each case, "one of the troops." In each program, this approach was very collegial and supportive. An increased emphasis on technology and teacher preparation has led to a corresponding increase in funding, particularly through the federal Preparing Tomorrow's Teachers to Use Technology (PT^3) program. This funding has allowed programs to move forward more quickly than in "the long march" as described by Mergendoller et al. (1994). This catalyst money has allowed programs to take larger steps, although there was a clear concern about sustainability of efforts in the majority of the programs. Finally, as would be expected, given the intervening years and advances with technology, the sophistication and breadth of use has increased markedly.

In spite of these differences, there are clearly many similarities with exemplars in 1994 and 2003. Although no one prescription for implementing technology in teacher education will work for every program, three common key elements identified in both the 1994 and the current study could serve as cornerstones for guiding programs in the implementation process:

- Technology experiences must be coordinated to ensure efficient, effective implementation of the standards.

- The norms, expectations, and philosophy of the program provide direction. A unifying theme is essential to ensure the lasting effects of the innovation.
- Having a shared vision among members of the teacher education program (Sergiovanni, 2000) nurtured with effective leadership is critical.

Without these essential elements, the implementation of the ISTE standards, like so many educational innovations before them, may have little lasting impact.

Coordination of Experiences

Mergendoller et al. (1994) found that in order to effectively prepare preservice teachers to use technology, technology must be an integral part of the teacher preparation program—not just a course requirement. To ensure that the standards are being addressed in the many courses, programs in this study utilized a curriculum mapping exercise to make sure that each component of the standards was addressed somewhere in the course sequence. This proved to be an effective way to ensure the dispersal of the standards throughout the program. The process, however, has two limitations. First, this effort could be cumbersome in larger programs with many faculty members. The greater the number of instructors and courses offered, the greater the potential for logistical impediments to a uniform approach. Also, this periodic curriculum mapping process does not ensure that new developments and possibilities are incorporated into the sequence.

Wake Forest recognized the importance of coordinating course experiences and staying on the cutting edge of educational technology practice and designated a faculty position to coordinate all of the technology experiences in the teacher education program. This faculty member is responsible for working one-on-one with individual methods faculty to facilitate the co-development of subject-specific incorporation of technology into the program. In this way, continual revision and redesign of technology experiences in different courses is not only possible, with regular meeting of the technology instructor and other faculty, it is likely.

The University of Virginia is approaching the challenge of coordination in a different way. The Educational Technology Council was formed to ensure continuity of vision and implementation of technology experiences within the teacher education courses. Faculty representatives from each of the following areas serve on the council:

- Science and Mathematics
- Humanities
- Special Education
- Elementary Education
- Teacher Education
- Instructional Technology

The council hopes to ensure that technology integration throughout the teacher education program is grounded in appropriate use of technology in each area of focus.

Whatever the specific approach employed, the key is to have a formal coordination of efforts. In this way, technology skills and concepts can be addressed in an efficient and appropriate manner throughout the program.

A Unifying Theme

In 1994, Mergendoller et al. identified the importance of having an organizational culture that focuses on supporting and encouraging faculty to incorporate technology in their courses rather than through mandates. For a new initiative or innovation to become integrated as part of the organizational culture, the faculty must embrace and make the innovation their own, and the program must change to encapsulate this new vision. Rogers (1995) referred to this as clarifying and restructuring. This was most often accomplished in the programs in this study through a unifying theme that the faculty could support. For Wake Forest and Arizona State University West, this unifying theme was a reflective electronic portfolio. At the University of Virginia and the University of Texas, Austin, this entailed use of technology to support pedagogically sound content-area instruction. Although the theme would necessarily be situation-specific, the key is that the emphasis is not on "teaching technology," but rather using technology as a tool to support the philosophical orientation of the faculty. A faculty member at Arizona State West commented, "These are those tools that fit in the teacher's hand like a fine art tool fits in the hand of a fine artist. They do not make the artist."

A Shared Vision

The central role of leadership was identified by Mergendoller et al. (1994) as essential to the success of the programs studied. He noted the critical role played by the deans of the programs. The results of this study emphasize the key role of individuals leading a democratic process of implementation. Along with this unifying theme, it is important that a shared vision be developed. Developing a shared vision does not come from top-down mandates, policy, or vision statements alone, or through the simple imposition of a set of standards (Sergiovanni, 2000). Rather, dialog and a democratic approach in which critical thought is encouraged rather than stifled leads to a sustainable vision. In this way, this shared vision is achieved through a series of discussions, meetings, and open forums, in which the innovation is altered to fit the unique context of the organization and individuals involved (Rogers, 1995).

Sergiovanni (2000) stated, "With shared visions, values, and beliefs at its heart, culture serves as a compass setting, steering people in a common direction" (p. 1). This shared vision serves as a means to keep the emphasis on technology rooted in the values of the program. Without this filter through which innovations are viewed, there could be a temptation to adopt every new idea or program that comes along. Fullan (2001) noted that with a shared vision, a different view prevails. A shared vision fosters the "capacity to seek, critically assess, and selectively incorporate new ideas and practices" (p. 44).

Conclusion

In many ways the findings from the current study support the 1994 conclusions as well as current literature in the field of technology and teacher education. There is clearly an increased emphasis on incorporating technology throughout the teacher preparation program, particularly in modeling use in teaching methods courses. The integration of technology is largely faculty-driven, with ample infrastructure and support mechanisms as key elements for success. This approach has led to authentic use of technology in methods courses and substantial buy-in on the part of faculty.

One surprising finding seems to fly in the face of many current approaches to fostering technology integration, however. Although many current approaches utilize stipend-driven workshops and/or formal mentoring relationships, participants in this study identified pedagogical issues ("it's good for the students" and/or "it supports pedagogy in my area") and personal support from colleagues as effective motivators. The value of monetary rewards to encourage change cannot be ignored; however, it is equally important to understand and support the pedagogical and personal values of faculty in the process.

Although the scope and detail of this study was limited to seven teacher education programs and the individual perspectives of those instructors who participated in the study (a maximum of three at any one site), it is helpful to understand how these exemplary programs are approaching the preparation of preservice teachers to use technology and the key factors in implementation. The common essential elements from the Mergendoller et al. and current studies help to create a roadmap to help guide those programs to develop and strengthen the integration of technology into teacher preparation.

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Appendix

Standard	ASU-West	Hope College	OSU-Mansfield	UT-Austin	UVA	VCSU	Wake Forest Elem./Sec.
Technology Operations and Concepts a. Demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Education Technology Standards for Students) b. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.	*EMC 300* RDG 402	ED 225 *ED 226* ED 285 ED 280 *ED 281* ED 287 ED 220 *ED 221* ED 500 *ED 470* *ED 480*	**PL 370** **PL 600** ***TL 693.10*** TL 866	EDC 371b EDC 371c BIO 337 or CH 368 or PHY 341 M 310 M 333	**EDLF 345** **EDLF 545** **EDLF 546** **EDIS 288**	***EDUC 300*** EDUC 200 EDUC 320 EDUC 323 EDUC 355 PSYC 352 EDUC 350	***EDU 307 EDU 607*** EDU 221 EDU 697 EDU 222 EDU 712 EDU 293 EDU 654 EDU 294 EDU 295 EDU 296 EDU 298 EDU 354 EDU 382 EDU 311 EDU 721 EDU 707 EDU 715 EDU 201 EDU 201 EDU 381 EDU 681 *EDU 202 EDU 3/664* *EDU 203 EDU 3/674* *EDU 250*
Planning and Designing Learning Environments and Experiences a. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners. b. Apply current research on teaching and learning with technology when planning learning environments and experiences. c. Identify and locate technology resources and evaluate them for accuracy and suitability. d. Plan for the management of technology resources within the context of learning activities. e. Plan strategies to manage student learning in a technology-enhanced environment.	***EMC 300*** ECD 404 RDG 401 DCI 303 ECD 400 ECD 401 ECD 402 EED 402 EED 380 EED 401 SPF 401 *RDG 402*	ED 310 *ED 311* ED 286 ED 360 *ED 361* ED 282 *ED 283* ED 285 ED 287 ED 220 *ED 227* *ED 470* *ED 480*	***TL 693.10*** TL 708 - TL 709 TL 729 - TL 731 TL 702 - TL 706 TL 705 TL 737 - TL 738 *TL 866*	UTS 101 UTS 110 EDC 371a EDC 371b EDC 371c M 310	**EDLF 345** **EDIS 288** **EDLF 545** EDIS 545 EDIS 550 EDIS 560 *EDIS 388* *EDIS 488* *EDIS 588*	***EDUC 300*** EDUC 200 EDUC 240 EDUC 315 EDUC 320 EDUC 321 EDUC 322 EDUC 323 EDUC 330 EDUC 355 PSYC 430 *EDUC 350*	***EDU 307 EDU 607*** EDU 221 EDU 697 EDU 294 EDU 654 EDU 295 EDU 354 EDU 296 EDU 298 EDU 382 EDU 381 EDU 681 *EDU 250 EDU 3/664* *EDU 3/674*

Plain Text = Methods Course | Underline = Other Education Course | **Bold** = Technology Course | *Italics* = Field Experience/Practicum
XXX 123 *XXX 124* = Course with concurrent practicum | XXX 123 – XXX 124 = 2 semester course | XXX 123 XXX 223 = elem../sec. program

Standard	ASU-West	Hope College	OSU-Mansfield	UT-Austin	UVA	VCSU	Wake Forest Elem./Sec.
Teaching, Learning and the Curriculum a. Facilitate technology-enhanced experiences that address content standards and student technology standards. b. Use technology to support learner-centered strategies that address the diverse needs of students. c. Apply technology to develop students' higher order skills and creativity. d. Manage student learning activities in a technology-enhanced environment.	***EMC 300*** ECD400 DCI 303 ECD 404 RDG 401 SPF 401	ED 225 *ED 226* ED 280 *ED 281* ED 312 ED 286 ED 282 *ED 283* ED 285 ED 360 *ED 361* ED 310 *ED 311* ED 220 *ED 221* ED 287 *ED 470* *ED 480*	**PL 370** **PL 600** **TL 693.10** TL 708 - TL 709 TL 729 - TL 731 TL 702 - TL 706 TL 705 TL 737 – TL 738 MTH 105 - MTH 106 *TL 884.10* *TL 866*	UTS 110 EDC 371b EDC 371c	**EDLF 345** **ELDF 545** EDIS 545 EDIS 550 EDIS 560 *EDIS 388* *EDIS 488* EDIS 588	***EDUC 300*** EDUC 200 EDUC 240 EDUC 315 EDUC 320 EDUC 321 EDUC 322 EDUC 323 EDUC 330 EDUC 355 PSYC 352 PSYC 430 *EDUC 350*	***EDU 307 EDU 607*** EDU 221 EDU 311 EDU 222 EDU 654 EDU 294 EDU 697 EDU 295 EDU 354 EDU 296 EDU 298 EDU 382 EDU 311 EDU 381 EDU 681 *EDU 203 EDU 3/664* *EDU 250 EDU 3/674*
Assessment and Evaluation a. Apply technology in assessing student learning of subject matter using a variety of assessment techniques. b. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning. c. Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.	***EMC 300*** ECD 400 EED 402 ECD 401 ECD 402 ECD 404 EED 401 EDP 302	ED 225 *ED 226* ED 285 ED 280 *ED 281* ED 310 *ED 311* ED 360 *ED 361* ED 220 *ED 221* ED 500 *ED 470* *ED 480*	**PL 370** **PL 600** **PL 693.10** TL 708 – TL 709 TL 729 – TL 731 TL 702 – TL 706 TL 705 TL 737 – TL 738 TL 607 *TL 884.10* *TL 866*	UTS 101 UTS 110 EDC 371a EDC 371b EDC 371c M 310	**EDLF 345** ***EDLF 545***	***EDUC 300*** EDUC 200 EDUC 240 EDUC 315 EDUC 320 EDUC 321 EDUC 323 EDUC 355 PSYC 352 PSYC 430 *EDUC 350*	***EDU 307 EDU 607*** EDU 221 EDU 697 EDU 382 EDU 654 EDU 294 EDU 354 EDU 295 EDU 296 EDU 298 EDU 381 EDU 681 *EDU 202 EDU 3/664* *EDU 203 EDU 3/674* *EDU 250*

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Appendix, con't

Standard	ASU-West	Hope College	OSU-Mansfield	UT-Austin	UVA	VCSU	Wake Forest
Productivity and Professional Practice a. Use technology resources to engage in ongoing professional development and lifelong learning. b. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning. c. Apply technology to increase productivity. d. Use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.	*EMC 300* RDG 401 ECD 400 EED 404 EED 402 EED 380 EDP 302 SPF 401 *RDG 402*	ED 225 *ED 226* ED 285 ED 280 *ED 281* ED 285 *ED 286* ED 310 *ED 311* ED 360 *ED 361* <u>ED 220</u> *ED 221* *ED 470* *ED 480*	**PL 370** **PL 600** **PL 693.10** TL 708 – TL 709 TL 729 – TL 731 TL 702 – TL 706 TL 705 TL 737 – TL 738 TL 925 *TL 884.10* *TL 866*	UTS 101 UTS 110 EDC 371a EDC 371b EDC 371c M 310	**EDLF 345** **EDLF 545** **EDLF 545** **EDIS 288** EDIS 545 EDIS 550 EDIS 560	*EDUC 300* EDUC 200 EDUC 240 EDUC 315 EDUC 320 EDUC 321 EDUC 322 EDUC 323 EDUC 330 EDUC 355 <u>EDUC 450</u> <u>PSYC 352</u> <u>PSYC 430</u> *EDUC 350* *EDUC 490*	*EDU 307 EDU 607* EDU 221 EDU 697 EDU 382 EDU 654 EDU 354 EDU 294 EDU 295 EDU 298 EDU 293 EDU 311 EDU 311 *EDU 250 EDU 3/664* *EDU 3/674*
Social, Ethical and Legal Issues a. Model and teach legal and ethical practice related to technology use. b. Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities. c. Identify and use technology resources that affirm diversity d. Promote safe and healthy use of technology resources. e. Facilitate equitable access to technology resources for all students.	*EMC 300* ECD 400 ECD 401 *RDG 402*	ED 225 *ED 226* ED 280 *ED 281* ED 310 *ED 311* ED 282 *ED 283* ED 312 <u>ED 220</u> *ED 221* ED 500 *ED 470* *ED 480*	**PL 370** **PL 693.10** TL 306 TL 718 *TL 884.10*	UTS 110 EDC 371a EDC 371b EDC 371c	**EDIS 288** **EDLF 345** **EDLF 545**	EDUC 200 EDUC 240 EDUC 315 EDUC 320 EDUC 322 EDUC 323 EDUC 355 PSYC 352	*EDU 307 EDU 607* EDU 221 EDU 697 EDU 222 EDU 712 EDU 293 EDU 654 EDU 294 EDU 295 EDU 296 EDU 298 EDU 354 EDU 382 <u>EDU 201 EDU 201</u> <u>EDU 381 EDU 681</u> <u>EDU 707</u> <u>EDU 715</u> <u>EDU 721</u> *EDU 202 EDU 3/664* *EDU 203 EDU 3/674* *EDU 250*

Plain Text = Methods Course | <u>Underline</u> = Other Education Course | **Bold** = Technology Course | *Italics* = Field Experience/Practicum
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