Technology Mentor Fellowship Program: A Technology Integration Professional Development Model for Classroom Teachers

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ABSTRACT

This multi-year program was based on the premise a digital divide exists between the technology skill levels of public school faculties compared to those of undergraduate teacher education candidates. The Technology Mentor Fellowship Program (TMFP) matched technologically-proficient pre-service teachers with K-12 teachers to model technology as an instructional tool. A consortium consisting of seven school districts and a university designed an approach for integrating technology into teacher preparation programs that allowed over 5,000 high-need learners to access teachers prepared to teach in increasingly high-tech classrooms. Increasing technology knowledge and skills among participating teachers became evident during the program.

Keywords

Teacher education; adult learning; collaborative learning; professional development

During the past decade, we have witnessed how technology has been infused in education, especially how technology integration has been emphasized in teacher preparation programs. A few years ago, Moursund and Bielefeldt (1999) reported that faculty IT skills tended to be comparable with those skills of their students, yet faculty were not modeling the use of technology in their instruction. Different approaches such as the mentor-mentee model have been used to help faculty integrate technology. Faculty members are paired with one or more students with the student(s) serving as the technology mentor. This approach can yield a successful relationship, which is long and highly interactive. Whether this relationship influences faculty technology professional development is the major question addressed by this paper.

Statement of Problem

To begin this effort, one survey was conducted to determine the changes in Texas public schools regarding technology infrastructure, financial support for this infrastructure, staff development related to technology, and use of the technology infrastructure. The findings from the total survey indicated that both teachers and their students were in the initial stages of employing technology at the instructional level in 1998, but with equipment in place and professional development opportunities expanding, much expansion of Internet-aided classroom instruction was expected.

In addition to the influx of technology hardware in schools, professional development opportunities for educators increased substantially during this period. As a concurrent activity, another survey was conducted targeting all public and private teacher education programs at institutions of higher education in Texas. With goals similar to those addressed by Moursund and Bielefeldt (1999), this activity was designed to determine how and to what degree instructional technology was being incorporated into teacher preparation; and to determine the status of technology support to faculty and students provided by institutions of higher education. Analysis and interpretation of these data indicated Texas College of Education deans sensed an increased level of support for technology but many still felt that support for technology in their college was meager at best. Perceptions of COE deans were gathered about the adequacy of general skills training in technology received by pre-service teachers in their programs. Generally, the respondents noted that pre-service teacher skills were adequate regarding candidates' ability to operate a computer system, to use software and tools that were directly related to their own professional use (such as, productivity tools – databases, word processing, and spreadsheets). Respondents reported that pre-service teachers were just beginning to use multimedia in programs although, for the most part, they were not required to do so. They (pre-service teachers) seemed to possess the skills to produce multimedia programs with little assistance being provided by teacher preparation faculty.

Both surveys were then compared to see if Colleges of Education in Texas were indeed keeping pace with the advances in technology occurring in K-12 schools and whether teacher preparation programs were providing the necessary pre-service experiences in technology to teachers entering the profession. Comparisons indicated that at the time these surveys were conducted a majority of teacher preparation faculty in our College of Education, a part of a land grant university, was not integrating technology into the restructured field-based teacher preparation programs, nor were they encouraging their teaching candidates to become proficient with technology applications for the classroom.

Today's teaching candidates, having grown up with technology tools, are entering our institutions of higher education with a much greater comfort level for technology than many of today's public school faculty who grew up with television and computers, sans Internet resulting in an “Intergenerational Digital Divide.”

Using findings from these surveys, the authors identified the following needs to be addressed by this program:

- development of teacher education faculty, including classroom teachers serving as supervisors of field experiences of teaching candidates, to be proficient in the use of various instructional and communications technologies; and
- development of supporting strategies for faculty infusing technology into new teaching preparation programs.

Given these needs that led to the Technology Mentor Fellowship Program (TMFP), the following evaluation questions were phrased to guide what became a three-year inquiry. In order to emphasize the role of classroom teachers in the preparation of future teachers, the term, “school-based faculty” is used rather than “classroom teachers” throughout the remainder of this paper.

1. Can a mentoring program be implemented for school-based faculty to become proficient in the use of various instructional and communications technologies?
2. Can a mentoring program be developed to support school-based faculty with integrating technology into their curricula?

Related Literature

In the following section, the authors briefly examine technology use by undergraduate students, and professional development for educators.

Undergraduate Change Agents

Current undergraduate students are members of a wave of youth that overlays with the digital revolution that has transformed all corners of our society. Together these two factors have produced a generation that is not just a demographic bulge but also a wave of social change and transformation (Tapscott, 1997). Today's undergraduates have grown up in households with the greatest penetration of digital media. During the past few years, interactive technology has begun to pour into the schools with about 90 percent of all children today having used a computer (Debell & Chapman, 2003).

Some analysts predict a generational conflict brought on by the new technologies. But many see ways to pair the generations together to get the most benefit for all involved. One possibility is providing an inverted apprenticeship model with undergraduate students helping teachers with specific focused technology-based tasks followed by time spent observing and working with educators as they become comfortable using these technologies. This program was developed around the assumption that today's undergraduate students would assist other generations in learning new ways to use technology in public schools that have been slow to embrace new telecommunication technologies.

Professional Development in Educational Technology- ISTE Study

For some time, the professional literature has recorded that investment in preparing school-based faculty to use technology has not kept pace with the investment and subsequent changes in infrastructure. To illustrate, Moursund and Bielefeldt (1999) conducted a study for the International Society for Technology in Education (ISTE) commissioned by Milken Exchange on Educational Technology that surveyed about one third of the nation's schools, colleges, and departments of education. According to this report, teacher preparation programs do not provide future teachers with the kinds of experiences necessary to effectively apply technology in classrooms. Some of the findings were:

1. Most institutions reported that their infrastructure was well developed for carrying out their preparation programs, but some institutions reported deficiencies.
2. Faculty informational technology skills are comparable to the skills of their students, but they do not model those skills in their teaching.
3. Most pre-service teachers did not routinely use technology in their field experience even when technology was available in the K-12 classrooms.
4. Most pre-service teachers did not work under master teachers and supervisors who could advise them on informational technology classroom applications.

In discussing these findings, Mousund and Bielefeldt noted that college classrooms mirror the situation in K-12 classrooms where there is more opportunity to be in technology equipped classrooms than to experience that technology as instruction occurs and recommended that informational technology applications should be integrated throughout teacher preparation courses rather than being offered as standalone courses.

Professional Development for School-based Faculty

Embarking on an effort to teach and support teachers to use technology requires a considerable time commitment for both the professional development provider and the school-based faculty being "developed." Mehlinger (1997) estimates that more than 30 hours of instruction and application experience are needed for adoption of a tool or software application to occur. A decade ago, Rogers (1995) suggested that helping faculty adopt and integrate technology into their teaching should combine not only individual initiatives, but also top-down mandates, and consensus-building across constituencies of the institution. Integrating technology into teaching alters routine practices creating chaos and anxiety (Tough, 1982). Examining models of professional development for ideas and strategies to reduce the angst of learning and actually using new technology skills , Joyce and Showers (1995) report that when development efforts provide no strategies for peer support after the initial training activity between 5 to 10 percent of the participants will likely implement the targeted skill, when peer-coaching teams are part of the training program up to 75 percent of the participants may implement the skill, and when an entire school faculty is organized into peer-coaching teams following initial skill training up to 90 percent implementation of the targeted skill may occur. Yet unless professional development experiences are designed and implemented to provide a close relation between what school-based faculty learn and what occurs in their classrooms and schools, these professional development activities will have a small chance of having long term effects or change learner outcomes (Fullan & Stiegelbauer, 1991).

Administrative Support for Professional Development

Administrative expectations and support are necessary for any successful instructional change to occur in schools. Stated administrative goals for high levels of technology integration by faculty must be communicated explicitly and reinforced by technology access to enable extensive practice, excellent technical support to troubleshoot technical glitches, and quality professional development experiences that are individualized and provided in a comfortable environment. Given these consistent messages of organizational support and clearly communicated expectations by administrators, school-based faculty generally will support the school's technology integration goals (U.S. Department of Education, n.d.; Moursund, & Bielefeldt, 1999).

Organizational change in instructional technology integration does require sufficient facilities, resources, access, and support, but successful technology integration will only occur if faculty members have sufficient preparation and planning time (Becker, 1994; Ennis III & Ennis, 1995-6; Ertmer, 1999; Gilmore, 1995; Hunt & Bohlin, 1993; Lawler, Rossett & Hoffman, 1998; Schrum, 1999; Strudler & Wetzel, 1999; Walker, Ennis-Cole, & Ennis III, 2000; Yildirim, 2000). Supporting this position, Moursund & Bielefeldt (1999) recommend that educational leadership should provide time for planning how to integrate technology into courses; time for evaluating the impact of technology on student learning; and time for experimenting the effects that technology has on teaching and learning processes.

Procedures

Description of Technology Mentor Fellowship Program (TMFP) Model

The Technology Mentor Fellowship Program (TMFP) model of professional development matches technologically-proficient pre-service teachers with school-based and campus-based faculty to apply technology as an instructional tool in K-12 classrooms and college classrooms. Undergraduate student mentors, called Technology Fellows throughout the remainder of this report, and a web-based resource bank support campus and school-based teacher preparation faculty involved in professional development. The Technology Fellow-faculty dyads collaboratively develop learning objects across a wide range of content areas with the expectation that many of these digital learning objects will be integrated into online professional development courses for teachers. These digital learning objects hint of the synergy expected to be generated by these teams that result in a cadre of teaching candidates with substantial technology skills and communication skills in providing technology support. Through their direct experience with technology instructional development, both the Technology Fellows and their faculty partners gain a greater appreciation of what is possible regarding technology applications for their classrooms.

Recruitment of Teacher Education Faculty and Technology Fellows

Recruiting, providing technology skill-training, and monitoring the skill proficiency of Technology Fellows were among the initial processes undertaken during start-up for this three-year program. These processes were essential because the key strategy was to match technologically-proficient pre-service teachers with school-based faculty to model technology as an instructional tool in K-12 classrooms as well as college classrooms.

School-based faculty, who supervise field experiences of teaching candidates, and campus-based faculty were recruited to participate in this effort. Fortunately, this process was an "easy sell" with the recruitment of school-based faculty being coordinated through district technology directors who worked with building principals. As the program continued, demand for Technology Fellows outstripped the resources to provide additional fellows.

Technology Fellows were initially recruited from undergraduate teacher preparation students enrolled in educational technology courses. Program staff visited each class to explain the program and benefits for participating as a Technology Fellow, such as,

- paid training ($7.50/hr for 20 hrs of training)[1] to work as technology mentors using web resources, Microsoft productivity tools and coaching on communication and team-building skills before beginning their experience with faculty partners;
- a paid field experience ($7.50/hr for 10 clock hours per week)[1] with an opportunity to continue this experience across ensuing semesters;
- working with an experienced faculty member on an individual basis to learn about pedagogy and their personal views about teaching; and
- providing technology support to an individual faculty member for integrating technology into their instruction.

This recruitment strategy resulted in 69 of an expected 100 Technology Fellows during the first semester of the program. At the beginning of the second year of the program recruitment efforts were expanded to all teacher preparation classes with disappointing results. Paid advertisements over a local radio station and in the campus paper for Technology Fellows at the beginning of the semester produced quite different results. The radio ads produced very modest returns for the cost, but the campus paper ads resulted in doubling the number of Technology Fellows within a three-week period. Advertising in the campus newspaper was used throughout the remaining semesters of the program with much success.

Faculty Orientation and Technology Mentor Training

An implementation schedule consistent with suggestions on mentoring and coaching (Clark & Denton 1998; Loucks-Horsley, Hewson, Love & Stiles, 1998) was developed for participating faculty members and the Technology Fellows. The following figure delineates tasks suggested to faculty members agreeing to work with Technology Fellows by program staff as a beginning point in the just-in-time technology professional development experience.

First month

- Meet face-to-face with Technology Fellow at school or departmental meeting.
- In initial session with Technology Fellow, complete Profiler (an online tool that compiles self-ratings of technology skills. This tool is available at <http://profiler.hprtec.org/>) and suggest possible programs while reviewing electronic learning objects available on the program website.
- Establish a calendar for mentoring sessions and outline tasks/programs/due dates for the next two months or remaining weeks in the semester.
- Contact program staff if assignment will not work due to scheduling or other reasons.

Second and third months of semester

- Begin with a project such as developing a web-page with Technology Fellow (if you do not have a web-page) and/or a Track project using the TrackStar tool (an online resource that organizes websites for a lesson or presentation. This tool is available at http://trackstar.4teachers.org/trackstar/).
- Plan to develop two or three projects during the coming 6 to 8 weeks in the semester.
- Approve weekly reports of the Technology Fellow.
- Communicate weekly with Technology Fellow to share work on projects and discuss ideas to complete the projects.

Fourth through eighth months of program

- Take stock of projects completed and needs for integrating technology into courses.
- Participate in an early Spring Semester seminar with Technology Fellow on progress and future steps.
- Develop a program calendar for the Spring Semester.
- Continue approving weekly reports of Technology Fellow.
- Complete end-of-year Profiler.

Figure 1. Suggested Activity Timeline for Tech Fellow-Faculty Member Dyad

These activities for the Technology Fellows and school-based faculty are consistent with recommendations of a recent large-scale empirical examination of professional development experiences. The evaluation team comprised of Garet, Porter, Desimone, Birman & Yoon, (2001) reported that professional development experiences that emphasize academic subject matter (content), provide opportunities for “hands-on” activities (active learning), are integrated with ongoing classroom operations (coherence), and provide many development experiences for an extended period of time are more likely to produce desired knowledge and skill changes. Similar recommendations are reported by Lewis, et al., (1999) that collaborative activities for professional development should include a common planning time, regularly scheduled meeting times, having a formal mentoring relationship, and networking with other teachers outside a single school. These recommendations are consistent with the timeline activities our program team developed and employed across the program.

Continuing Professional Development of Technology Fellows

Initial and continuing skill development experiences were provided to Technology Fellows in the program laboratory containing twenty workstations equipped with Microsoft Office Suite software including graphic and web development applications. The Microsoft Office

Suite included Microsoft Word for word processing, Microsoft Excel for developing spreadsheet activities and charting, Microsoft PowerPoint for creating presentations, Microsoft Publisher for desktop publishing, and Microsoft FrontPage for developing web pages. The laboratory was open from 8:00 AM to 5:00 PM Monday through Friday for Technology Fellows' use in developing projects in collaboration with their faculty partners, as well as, upgrading their skills. During year 2, program staff began developing and implementing online professional development lessons for new Technology Fellows that effectively reduced face-to-face training sessions from 20 hours to 2 hours, with the remaining experiences being provided through online instruction. Formative evaluation of the training experiences (by staff and the program's external evaluators) indicated the online lessons were very effective skill development tools. The quality of the artifacts produced by the Technology Fellow was virtually the same regardless of whether the Technology Fellow completed the face-to-face instruction or the online instruction. The second year of the program also marked the beginning of Intel training for all Technology Fellows by a program staff member. The Intel curriculum was provided in addition to the development experiences that were used when the program began.

Data Collection
Electronic Management System

An Electronic Management System (EMS) was developed to track the Technology Fellow assignments; to provide work schedule targets; to provide payroll information; to serve as a repository for electronic learning objects or projects developed by the Faculty-Technology Fellow teams; and to serve as an online communication system for the Technology Fellows, the Program Coordinator, and the Faculty members who worked with the Technology Fellows. The EMS utilizes the Internet to address challenges associated with multiple levels of communications, program management and monitoring of electronic instructional object development. The following data were collected, compiled and stored via the EMS.

Formative Data

At the conclusion of each semester, **school-based faculty** completed an online questionnaire to reflect their perceptions about their experiences in the program ranging from 1 (strongly disagree) to 5 (strongly agree). Across three years, 202 school-based faculty members participated in this experience with 86 individuals participating for at least two years with 23 to 35 school-based faculty completing the questionnaire each semester. This online tool provided formative data to the authors about daily operations and curricula offered by the program. The following figure provides brief summaries across items on this questionnaire.

1SB. *Overall, participating in this program was beneficial to me.* Faculty ratings ranged from **4.03 to 4.46** across semesters with the lowest and highest ratings occurring during the final program year.
2SB. *The program provided a support network of online resources and personal assistance.* Faculty ratings ranged from **4.00 to 4.28** across semesters with the highest rating occurring during the final program year.
3SB. *This program has or will impact my work in the classroom*. Faculty ratings ranged from **4.03 to 4.30** across semesters with the lowest and highest ratings occurring during the final program year.
4SB. *This program has or will assist me in helping others use technology*. Faculty ratings ranged from **3.88 to 4.00** across semesters with the lowest and highest ratings occurring during the final program year.
5SB. *This program has or will assist me in helping others integrate technology into the curriculum, after-school or community program.* Faculty ratings ranged from **3.87 to 3.97** across semesters with the lowest rating occurring during the final program year.

Figure 2. Formative Data Summaries on Program Effects

Additional support that the technology fellows did provide valued and needed assistance is provided from the following comments gleaned from school-based faculty at the conclusion of the three year experience.

"The TrackStar set up was especially beneficial for not only my students, but to others who used it. Although I had been shown how to set up TrackStar, I still had many questions and was unsure how to get things done. Jennifer helped lighten my load."

"I have learned more about TrackStar and how to utilize lessons that are already in place. I have been able to present good information to the students that I would not have had the time to complete on my own."

"I have been able to develop a usable web page for my classroom."

"If you get a reliable tech fellow, the program works much better."

"I wish that I had more time to devote to this. It takes a lot of time out of my schedule here at school, and sometimes that is a hindrance."

"I have found new web sites that reinforce what we do in class."

"I have become more proficient with my use of the computer and have been able to communicate data to teachers, staff and administration more effectively."

"I have gained an understanding of power point as a mindtool."

"I have had a positive experience with technology in my classroom."

"I have been able to present great information to the students in a motivating format that is very interesting and informative for them. As a coach, classroom teacher, science fair coordinator, and parent, I would have great difficulty completing all the projects that we used to present to my students. I have a touch-screen board in my class this year and the lessons Melanie helped to create and find were invaluable to use in presentations to the students on various subjects. In addition, she came to our computer lab to help my students with their science fair projects when we were typing the reports and preparing the information for their project boards."

Summative Data

During year 3, program staff began a data collection activity under the auspices of a U.S. Department of Education program (P342B010016A), entitled Knowledge Innovation for Technology in Education (KITE), with a consortium of universities led by the University of Missouri-Columbia. The idea for data collection was to simply invite classroom teachers to tell a personal story about using technology in their classroom during a brief interview. This story was then classified and categorized as a case, then stored with other cases for retrieval using a search engine. The following figure is from a case collected from a school-based educator who had been mentored by a Technology Fellow the preceding year. This case (Case Number 7007-1) is available at http://kite.missouri.edu/

Teacher: I really didn't know what to expect when I was given a Tech Fellow. … I really didn't understand what I was getting the Tech Fellow for because I teach five different preps. Initially, I think the Tech Fellow was to help me integrate technology with math models, but that did not pan out, so we put our efforts toward another prep that I taught on team leadership.

As my technology mentor, she came in and we talked about how we were going to integrate technology with team leadership instruction. … Team leadership is really about teaching life skills and students are evaluated on speeches they make. We decided the students would develop and present a PowerPoint presentation on the topic, "A relationship that is important to me and why." Students individually developed slide presentations in the computer lab during the two days we reserved the lab and then they presented their slide presentation. I felt this activity was successful because students were actually interested in doing this presentation. They actually were "hands-on" with the PowerPoint application and it was successful.

Interviewer: Why would you say that it was successful?

Teacher: 100% turn out! Everyone actually did the assignment. It is kind of embarrassing to say that you actually have 100% participation and that is a success. But today, many kids simply do not do their work. For this activity they actually found it interesting and were engaged in the assigned activity. Thinking about it, they did not have to sit and listen to me talk, take notes and fill out notebooks. Rather, they created their messages on computers and then delivered their messages. From this experience, I think that using technology is a plus.

Figure 3. Campus-based Faculty Account of Tech Fellow Support

Findings and Interpretations

The preceding data and deliverables associated with the program were organized into the following evaluation question summaries. ***Evaluation Question 1: Can a mentoring program be implemented for school-based faculty to become proficient in the use of various instructional and communications technologies?***

Outcome. Across the first full year of program implementation, the Technology Fellow placements numbered 99 with school-based educators during both the fall and spring semesters. During the final year, Technology Fellow placements numbered 104 during both semesters with school-based faculty. Across the program, 202 different school-based faculty participated in this mentoring program, 86 of whom participated multiple years. Given the formative and summative data gathered about school-based faculty perceptions about their experiences in the program, evaluation question 1 can be answered in the affirmative.

Analysis and Interpretations. After we adjusted the recruitment process and increased the orientation activities of Technology Fellows and school-based faculty, the implementation process became more efficient and effective. End-of-year surveys and interviews conducted during the spring semesters, as well as the requests from school-based faculty to continue their work with their Technology Fellow the following year support our impressions about the stability of placements, and the functioning of the program. An additional observation that this inverted apprenticeship model was successful was the observation listed earlier that as the program continued, the demand for tech fellows by campus-based faculty exceeded the number of fellows our program could provide.

Evaluation Question 2. Can a mentoring program be developed to support school-based faculty with integrating technology into their curricula?

Outcome. A large number of electronic objects (1,043) were created across a wide range of content areas and can be accessed from the Electronic Management System (EMS) website <http://tmfp.coe.tamu.edu/programs/>. Table 1. provides an abbreviated list of the types of learning objects that were developed by the Faculty-Technology Mentor dyads over the course of the program.

Table 1. Sample of Electronic Learning Objects

Project Format	Examples from the EMS Project Database
TrackStar Project	- Balancing Chemical Equations - Use of Technology in Art - Attributes of Performance Objectives - Math for First Graders
Learning Resource Using: QuizStar, PBL (Project Based Learning), Web Worksheet Wizard, or Comparable Tools	- The Solar System: Brochure - Student Sample Presentation: Charlie and the Chocolate Factory - Classroom Newsletter
HTML Page/Web Site	- The Wonderful World of Weather - Learning Theory Web Site - Career Investigation
MS PowerPoint or Comparable Slide Show	- Shapes - Healthy Eating - Teacher-Child Communication - Texas Independence
HyperStudio or Comparable Multimedia Project	- Legend of the Bluebonnet - Parliamentary Procedure
Spreadsheet	- Free Fall and Terminal Velocity Graphs - Styrene Production via Ethylbenzene Dehydrogenation
Word Processor Document	- Rainforest Unit - Discovering Pi - Pythagorean Theorem Lab - Collecting and Using Data
Handheld Activity	- Graphing Applications Using Your Pocket PC - The Food Pyramid

These digital resources have been developed across a broad continuum of learners for instruction in mathematics, science, social studies, language arts, history, English, ESL, teacher education, technology, reading, graphics design, fine arts, economics, physical education, special education, French, agriculture, and business education. Given the number and breadth of learning objects developed for instructional purposes, we believe this question can be answered in the affirmative.

Analysis and Interpretations. The large number of electronic resources developed across the program suggests faculty have begun to integrate electronic learning objects in their instruction. Yet during the program, faculty members often needed help in identifying quality web resources for their classes. In response, demonstrations of an array of resources available to them were conducted. The idea that we must keep in mind is that substantial interest was exhibited by faculty members during this program to integrate technology into their courses, but sustaining this level of technology integration will require continued organizational support.

Discussion

School-based teacher education faculty are willing to engage in technology professional development experiences delivered by a Technology Fellow (undergraduate student) if the professional development activities are tailored to the faculty member's individual needs, and program assignments are arranged to fit her/his time schedule. Our results support the work of Garet et al., (2001) who report that professional development experiences that emphasize content, provide active learning opportunities, are coherent with ongoing classroom operations, and provide many development experiences for an extended period of time can produce desired knowledge and skill changes.

The key to a successful technology professional development experience using an inverted apprenticeship model is to establish a dyad (faculty member and Technology Fellow) that opens communication channels quickly with the dyad members establishing regular meeting times to collaborate and share ideas, techniques and program products. This concluding idea is consistent with the work of Lewis et al., (1999) that collaborative activities for professional development based on a formal mentoring relationship can be quite successful.

We conclude with a thought about why this professional development model is important for the preparation of teachers. As technology knowledge and skills grow among classroom teachers who supervise teaching candidates in their field experiences, the issue of encouraging future teaching candidates to integrate technology into their class activities will occur naturally through modeling what they have directly experienced.

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