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Technology Integration into Teacher Preparation:Part 2—Theory into Practice

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ABSTRACT

In Part 1 of a two-part article series, the authors reported on the shortcomings of existing teacher preparation practice concerning technology and teacher education and described the theoretical grounding behind one model for integrating technology into teacherpreparation (Duran & Fossum, 2010). Part 2 here reports on a research project that applied the model at a major university in the U.S. Over a three-year period involving seven cohort groups, 246 educators participated in the study, which combined both quantitative and qualitative data collection and analysis. Findings indicate that over the course of the program, project participants significantly improved their confidence and competence in technology literacy as well as integration of information technology into the teaching and learning process. The study demonstrates that an approach to professional development that encourages networking, mutual learning, and sharing of strategies and resources among K-16 educators can be effective in improving technology integration in teacher preparation.

KEYWORDS: technology integration, teacher preparation, networked learning communities

Ögretmen Eğitiminde Bilgi Ve İletişim Teknolojileri Entegrasyonu: Bölüm 2—Model Uygulaması

ÖZET

İki seri halinde sunulan araştırmaların birinci bölümünde (Duran & Fossum, 2010) öğretmen eğitiminde bilgi ve iletişim teknolojileri (BİT) entegrasyonu konusundaki mevcut eksiklikler tartışıldıktan sonra bu eksikliklerin giderilmesi için "bağlantılı öğrenme topluluğu" [networked learning community (NLC)] olarak tanımlanan bir model önerisi sunulmuştur. İkinci seride sunulan bu çalışmada, bu model önerisinin Amerika'daki bir üniversitede uygulamasıyla elde edilen sonuçlar sunulmaktadır. Üç yıldan fazla süren bu araştırmaya yedi ayrı grup halinde toplam 246 eğitimci katılmıştır. Verilerin toplanmasında ve çözümlenmesinde nitel ve nicel araştırma yaklaşımları birlikte kullanılmıştır. Elde edilen bulgular doğrultusunda, programa katılan eğitimcilerinin genel

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BİT kullanımı bilgileri ile BİT'lerin öğretme ve öğrenme ortamlarında kullanımına yönelik güven ve becerilerinin önemli ölçüde arttığı ortaya çıkmıştır. Bu bağlamda, BİT'in öğretmen yetiştirme programlarına entegrasyonu konusundaki etkili yöntemlerden birisinin, öğretmen eğitimi ile ilgili tüm eğitimcilerin (ilköğretimden üniversiteye kadar) birlikte çalışmalarını ve sınıf içi teknoloji kullanımı konusunu birlikte öğrenmelerini destekleyen NLC yaklaşımı olduğu sonucuna ulaşılmıştır.

ANAHTAR KELİMELER: bilgi ve iletişim teknolojileri entegrasyonu, öğretmen eğitimi, bağlantılı öğrenme toplulukları

THE THIRD STUDY: THEORY INTO PRACTICE

INTRODUCTION

In Part 1 of a two-part article series (see Duran & Fossum, 2010), the authors reported on the shortcomings of existing teacher preparation practice concerning technology and teacher education and described the theoretical grounding behind one model for integrating technology into teacher preparation. The first study, addressed in the "Practice" section of Part 1, highlighted the pressing need to develop models to integrate information technology into teacher preparation curriculum in ways that would address each of the critical components of technology integration—core course work, effective faculty modeling of instructional technology, and technology-enriched field experience. The second study, discussed at the "Theory" section of Part 1, described and analyzed the K 16 Networked Learning Community" (NLC) model for drawing these three components coherently together in a teacher preparation program.

In Part 2 of this article series presented here, the authors report on a researchm project that applied the NLC model at a major Mid-Western university in the United States where they put the theory into practice in a three year program called Michigan Teachers' Technology Education Network (MITTEN).

Two questions animated the research:

1. What is the impact of the NLC approach to professional development with regard both to technology literacy (knowing *about* technology) and to technology integration (teaching *with* technology) among K-16 educators?
2. What are the effects of specific kinds of professional development activities offered within the NLC context with regard to promoting and/or influencing participating K-16 educators' professional development on technology integration in the classroom?

In the following sections, the authors describe the MITTEN program, explain the research study that used multiple methods to determine the impact of the program, and present the study findings together with discussion of those findings. In a concluding section, the authors discuss ways in which the model presented responds effectively to the need for comprehensive program for preparing technology-proficient educators.

The MITTEN Project

The MITTEN project involved the School of Education and the College of Arts and Sciences of the university at which this study was conducted. A neighboring community college also participated, as did several K–12 school districts sponsoring the project's pre-service teachers during those students' clinical student teaching experiences. The project’s main goal was to prepare participating K-16 educators with improved knowledge, skills, and confidence regarding the integration of information and communication technology into the teaching and learning process. To this end, the project supported the redesign of computing, methods, and content courses and the enrichment of the student teaching phase especially via efforts to ensure that pre-service teachers met National Educational Technology Standards for Teachers (NETS*T, ISTE, 2000) throughout their programs.

Over a three-year period, MITTEN involved seven cohort groups, each participating in the program for two consecutive academic semesters. In each cohort, the project included five NLCs, each related to one of five fields of specialty: early childhood, language arts, social studies, mathematics, and science**—**fields that were highlighted because they corresponded to the future teachers’ academic majors and to the areas of expertise and interest among the postsecondary educators involved. Each NLC group typically consisted of four student teachers, their (four) cooperating mentor teachers from K-12 schools, one university field supervisor of student teaching appointments, one educational technology faculty, one methods faculty, and one content faculty member from related schools and colleges. The overarching task of each NLC was to develop and field-test authentic projects in which technology enhances teaching and learning in specific subjects.

MITTEN offered three different types of interrelated professional development activities to project participants: (a) capacity-building activities made available to participants based on identified need, (b) sequenced networked learning circle meetings of each NLC, and (c) a pair of interspersed whole-group seminar activities designed for the whole-group engagement of all project participants. Figure 1 shows the sequence of these events within a single cycle of the project. The meeting of networked learning circles and the work undertaken within these meetings were of core importance to the project, while the additional activities comprised important means of support for those circles.

All preservice teachers at the institution where the study was conducted were required to take an educational technology course prior to the culminating student teaching placement. MITTEN offered a set of Capacity Building Activities during a “preparatory semester,” involving the project's cooperating teachers, field supervisors, and methods and content faculty members, helping to improve their technology readiness and bring their technology skills more in line with those of the participating student teachers, These capacitybuilding activities included workshops, working lunch sessions, and one-to-one mentoring sessions, and the sessions generally addressed three areas of need—telecommunication tools, productivity tools, and educational multimedia. The specific thrust of each session corresponded to needs that participants identified on assessment surveys. Through the improvements in the participants' technology readiness and by aligning their skills more with those of the participating students, the cohort as a whole was better prepared to undertake the work that occurred during the subsequent "collaborating semester": designing and implementing technology-enhanced instruction.

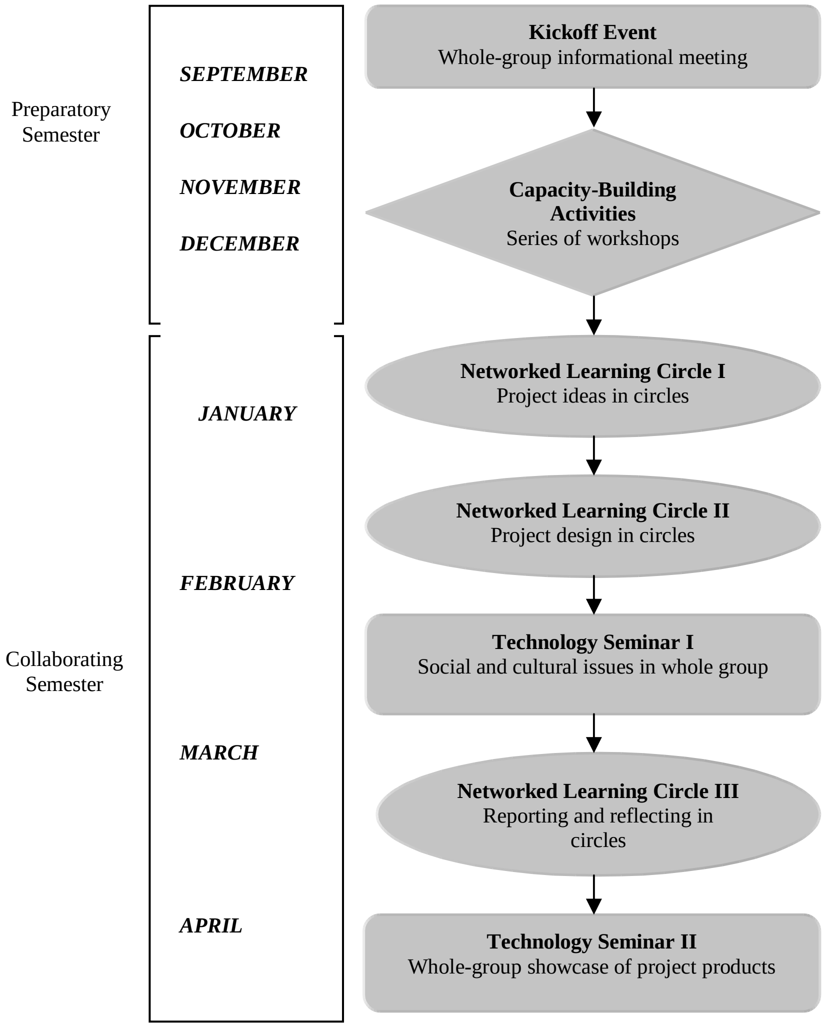

Figure 1. One round of MITTEN events.

Meetings of the Networked Learning Circle scheduled during the collaborating semester comprised the most critical set of activities. With each learning circle focused on one of five areas of specialty, the memberships of each circle had a common interest in improving instruction pertaining to a discrete content area. The five circles met a minimum of three times each group during the course of the term. In these circle meetings, the groups designed, revised, and implemented technology-enhanced practices in their instruction (consisting of course or unit redesign for K-12 participants, syllabi revision for the university-level participants). The first circle meeting provided inspiration and guidelines to encourage technology integration ideas among project participants and readied them to consider their instructional practices and how they might be improved through technology integration. At the second meeting, all circle members presented their proposals for technology integration into their professional practice. Student teacher/cooperating teacher pairs presented joint projects for their respective classrooms whereas faculty members and field supervisors focused on their own settings. During and after these presentations, other members of the circles raised questions and made suggestions for the content, technology, and pedagogy of the technology integration projects presented. A range of content, methods, technology, and practitioner experts in the networked learning circles supported each other with the design of technology-integrated projects. The presentation and discussion activities featured during the second meeting helped circle members for the classroom implementation phase of the cycle. The third meeting generally occurred after the completion of most of the implementation phase and provided time for each participant to report and reflect on successes and challenges encountered during implementation.

Seminar activities scheduled around meetings of the networked learning circles served two different but complimentary purposes. These seminars built awareness, first, of cultural and social issues dealing with educational technology through attention to topics such as the “assistive technology,” “digital divide,” and “plagiarism and copyright.” Second, via the showcasing of current efforts, an additional purpose of the seminar activities was to foster and sustain the momentum and interest of those involved. This is consistent with Fullan’s (2001) assertion that exchange of knowledge is at once not only a motivator but is in fact an integral attribute of the competent professional.

Each MITTEN participant was expected to create a standards-based electronic portfolio (Barrett, 2000) that documented their own progress in planning and executing technology-enhanced lessons. Each portfolio included five major sections consisting of an introduction, an overview, a narrative of achievements, exhibits, and reflections (see an example portfolio at http://www.umd.umich.edu/mitten/jbednark). Participants used these portfolios to reflect on their growth and learning and to demonstrate connections to the National Educational Technology Standards for Teachers (ISTE, 2000). Creation of e-portfolios enriched with technology-integrated lessons and learning resources provided avenues for networking among project participants in different cohorts and offered a key avenue for sharing experiences among project members and with others in the education community.

METHODOLOGY

Design

A mixed methods design described by Gay, Mills, and Airasian (2006) was used to study the effectiveness of the NLC model employed in MITTEN, thus combining both quantitative and qualitative data collection and analysis in order to appropriately answer the research questions. The first step of the study involved the dissemination of a needs assessment survey and the pre-test technology survey prior to the beginning of the program. The second step involved an ongoing collection of program participation data and artifacts from the program activities. The third step involved the administering the post-test technology survey. The final step involved the content analysis of the program participants' e-portfolios.

Participants and Setting

Over a three-year period with seven cohort groups, the subjects for this study included 246 educators (105 student teachers, 105 cooperating teachers, 28 university-level faculty, and 8 student teaching supervisors). With each new cohort group, the study was announced to student teachers six-months prior to the student teaching semester and volunteers were solicited to participate. Names of the volunteering students were placed in a box based on their field of study and four individual names were randomly drawn to select student teacher participants for each networked learning circle. Student teachers' assigned school districts identified cooperating teacher volunteers to team up with student teachers and participate in the study. Student teacher/cooperating teacher pairs were placed in 56 different schools (39 elementary, 4 middle, and 13 high schools) in 22 different school districts. The study was announced to faculty members and student teaching supervisors prior to each academic year and volunteers were asked to participate. A total of 12 methods, 13 content, 3 educational technology faculty, and 8 student teaching supervisors participated in the study. All 3 educational technology, 5 methods, 2 content faculty, and 3 student teaching supervisors were participated in multiple cohorts.

All participants attended capacity building activities, participated in networked learning circle meetings, and engaged in whole-group activities including a kickoff event, a technology seminar focusing on a featured social issue, and a final exhibition showcasing project products. Participants were expected to form and implement technology-rich lessons, maintain journals, and develop electronic portfolios. To gauge the capacity within the involved schools in terms of technical equipment and readiness, each participant conducted site

assessments using School Technology & Readiness (STaR) Charts (CEO Forum on Education and Technology, 2000) and then developed their projects and lessons considering the technology and resources available to them. There were wide disparities in the hardware, software, and technical support available to the project participants in their classrooms and schools. Some "high-tech" level schools had more than two computers with Internet access in each classroom in addition to other computer labs. These schools had the traditional computer labs as well as specialized labs with software and hardware for students to complete complex projects such as digital video editing and production. The schools within the "low-tech" group showed lack of technology resources. Classrooms had computers, but were not usually connected to the Internet. Labs and technical support were minimal. The majority of the schools in the project fell in between these two poles at the "mid-tech" level. The schools within this group generally had 1-2 computers with Internet access in each classroom and one computer lab at the elementary schools and 5+ labs at the high schools.
Specialized labs and projection capabilities within the classrooms were limited.

Instrumentation

A technology survey designed by the project's external evaluator was used to evaluate the project participants' technology confidence (comfort level) and competence (frequency of use) in two parts. Part I was comprised of two scales that consist of nine (9) items measuring participants' confidence/competence related to technology literacy (knowing *about* technology). Part II was also comprised of two scales with 13 items measuring participants' confidence/competence related to integration of technology into teaching and learning (teaching *with* technology). The external evaluator reported successful and satisfactory use of the technology survey for a number of years in different professional development programs, confirming its reliability. Additionally, a panel of experts in educational technology reviewed and revised the instrument for content validity. The researchers developed and used a guideline for journal entries underlining the purpose of the journals and its framework to help participants in writing their respective "evaluative journal" entries. The researchers also developed and used an electronic portfolio guideline describing the purpose of the electronic portfolio and its framework to help participants to present their achievement in teaching with technology in a meaningful way.

Data Collection

Various forms of data were collected related to each of the research questions. A combination of quantitative and qualitative methodologies were employed, including (a) quantitative data collected from the pre- and post technology surveys, and (b) qualitative data collected from the needs assessment survey, participants' journal entries, participant observations in networked learning circle meetings, and technology projects and summary reflections within the electronic portfolios.

Data Analysis

The research questions drove the data analysis. Five-point Likert scales were used to measure participants' confidence (1 = very anxious or even afraid of to 5 = eager) and competence (1 = never to 5 = daily) in both technology literacy and integration of technology into teaching and learning. A paired-samples *t* test was conducted to compare means for the same variable measured at two time points (e.g., pre-test and post-test) on the same set of subjects (Hinkle, Wiersma, & Jurs, 1994). To treat the missing data, the researchers excluded cases analysis by analysis and used all cases that had valid data for two variables in a pair in the test for that pair. Qualitative data analysis of the needs assessment survey, the journal entries, and the reflections articulated in electronic portfolios were conducted on a continuous basis throughout the program. The researchers organized and sorted data as they were collected and followed three repeating steps (reading/memoing, describing, and classifying) in analyzing qualitative data (Gay et al., 2006) for the retrieval of information and understanding of the data.

RESULTS

The Impact of the MITTEN Program

The paired-samples *t*-test results indicated that over the course of the program the project participants significantly improved their confidence and competence in technology literacy as well as the integration of information technology into the teaching and learning process. As shown in Table 1, the paired-samples *t*-test results for Part 1 (Technology Literacy) on the survey indicated a significant increase (at the .05 level) in scores from pre-test to post-test for each item tested on the survey.

Table 1. *Paired-Samples T-Test Results: Part 1-Technology Literacy*

Survey Question	**Degree of Freedom (df)**	**Comfort (2 tailed <.05sig.)**	**Frequency of Use (2 tailed <.05sig.)**
1. Use computer for the "ordinary" purposes: word processing; opening, modifying, printing documents; record keeping.	174	-3.175 (.002)	-2.986 (.003)
2. Use computer and appropriate software to use or create databases and spreadsheets.	174	-3.612 (.000)	-.2.908 (.004)
3. Use computer for the most "common" purposes of connectivity: sending and receiving e-mail including	174	-4.185 (.000)	-4.639 (.000)

attachments; using URL's and search engines on the Internet; retrieving, saving and using electronic information.			
4. Create multimedia presentations including sound, graphics, or animations in an application such as Appleworks, HyperStudio, PowerPoint, KidPix, Avid Cinema.	174	-7.595 (.000)	-9.283 (.000)
5. Use more "advanced" computer functions such as chatrooms; QuickTime movies; video input, manipulation and output; large-group presentations connecting computer and projection devices.	174	-3.574 (.001)	-5.712 (.000)
6. Use graphics to create professional-looking documents, newsletters, publications; these might include such programs as PrintShop or Corel Draw, clip art from disks or the Internet, or the use of a scanner or digital camera.	173	-6.569 (.000)	-7.533 (.000)
7. Create and modify a personal or professional web page.	172	-8.319 (.000)	-10.529 (.000)
8. Employ technology in assessment (e.g. electronic portfolios or gradebooks).	170	-8.154 (.000)	-8.154 (.000)
9. I am aware of controversial aspects of technology use including data privacy, equitable access, free speech issues; understand ethical use issues and know the differences among freeware, shareware and commercial software; understand university or school district's policies related to these issues.	170	-6.723 (.000)	-6.190 (.000)

The results of the *t*-test for Part 1 indicate that throughout their participation in the MITTEN program the project participants made significant increases in their use of computer for "ordinary" purposes such as word processing, opening, modifying, printing documents, and record keeping. Similar increases were made for using computer and appropriate software to utilize or create databases and spreadsheets. Participants also increased their use of computers for common purposes of connectivity such as sending and receiving e-mail with attachments, using Internet search engines, and retrieving, saving, and using electronic information. Significant increases were evident in the realm of creating multimedia presentations, using advanced computer functions such as using chat rooms, QuickTime movies, and video input, manipulation, and output. Participants increased their use of graphics application to create professional looking documents, newsletters, and publications, and they significantly increased the frequency with which they created and modified personal or professional web pages and employed technology in assessment such as using electronic portfolios or grade books. In addition, study participants significantly improved their understanding about some social and ethical issues related to technology use in the classroom such as data privacy, equitable access, free speech, copyright, and school technology policies.

As Table 2 illustrates, the paired-samples *t*-test results for Part 2 (Integration of Technology into Teaching and Learning) on the survey also indicated significant increase (at the .05 level) in scores from pre-test to post-test for each item tested on the survey.

Table 2. *Paired-Samples T-Test Results: Part 2-Integration of Technology into Teaching and Learning*

Survey Question	**Degree of Freedom (df)**	**Comfort (2 tailed <.05sig.)**	**Frequency of Use (2 tailed <.05sig.)**
1. Help students to operate a variety of hardware tools (e.g., computers, LCD projector, scanner).	170	-7.333 (.000)	-6.823 (.000)
2. Help students use video hardware and software in engaging and constructive ways rather than for passive viewing.	169	-6.420 (.000)	-9.462 (.000)
3. Help students use sophisticated and content specific applications as well as develop their abilities to learn applications outside of formal training.	166	-5.711 (.000)	-9.731 (.000)
4. Help students become proficient in using search tools and evaluating and using results of searches.	169	-7.008 (.000)	-8.743 (.001)
5. Develop and help students develop skills in creating multimedia presentations and	169	-8.535 (.000)	-9.906 (.000)

products that support engaged learning.			
6. Help students become skilled at developing technology-enriched learning activities that are authentic, multidisciplinary, and connected to district, state, and national standards.	168	-8.606 (.000)	-11.787 (.000)
7. Help students to utilize technology-enriched instructional strategies in which learning is highly interactive and responsive to student needs.	169	-7.851(.000)	-12.527 (.000)
8. Help students use technology to support authentic, performance-based, ongoing assessment including portfolios.	168	-7.148 (.000)	-10.805 (.000)
9. Help students understand how to create a classroom environment in which technology is a shared responsibility between teachers and students, and where its use is transparent and in need of limited teacher direction.	166	-5.555(.000)	-10.307 (.000)
10. Use tailored (to the individual or to small groups) editable learning modules (interactive electronic tutorials to teach specific lessons or material to specific students or groups of students).	164	-4.922 (.000)	-8.934 (.000)
11. Generally understand and use technology to enhance teaching and research.	168	-7.711(.000)	-8.424 (.000)
12. Generally understand and use technology to maximize student learning.	168	-7.986 (.000)	-9.172 (.000)
13. Mentor professional colleagues in using technology to improve teaching and learning.	168	-7.032 (.000)	-6.067 (.000)

The results of the *t*-test for Part 2 indicated that, throughout their participation in the MITTEN program, the project participants made significant improvements in helping students to operate a variety of hardware tools such as computers, LCD projectors and scanners, and to use video hardware and software in engaging and constructive ways. Similarly, participants made significant increases in the amount of time spent helping students use sophisticated and content-specific applications and in developing student abilities to learn applications outside of formal training. Accordingly, participants significantly improved their ability to help students become proficient in using search tools and evaluating and using results of Web searches as well as developing their skills and helping students develop skills in creating multimedia presentations and products that support engaged learning. Participants also made significant improvements in helping students become skilled at: developing technology-enriched learning activities that were authentic, multidisciplinary, and connected to district, state, and national standards; helping students to utilize technology-enriched instructional strategies in which learning is highly interactive and responsive to student needs; and helping students use technology to support authentic and ongoing performance-based, assessment including portfolios. Study participants significantly improved their ability to help students understand how to create classroom environments in which technology is a shared responsibility between teachers and students, and in which its use is transparent and in need of limited teacher direction. There was also a significant increase in the use of interactive electronic tutorials to teach specific lessons or material to specific students or groups of students. Further, participants made significant gains in understanding and using technology to enhance teaching and research and to maximize student learning as well as to mentor their colleagues in using technology to improve the teaching and learning process.

Document analysis of technology projects and electronic portfolios confirmed the findings of the survey results. Most project participants developed and implemented technology-integrated projects (leading to changes ranging from unit revision to course and syllabus revision) and included them in their electronic portfolios. Projects created by pre-service teachers and in-service teachers included reflections related to their development and effectiveness that were directly related to National Educational Technology Standards for Students (ISTE, 1998) and the state's curriculum standards. Faculty members' portfolios containing models for technology applications in university classrooms and for supervising student teachers' field experiences are also now available.

The MITTEN Web page (http://www.umd.umich.edu/mitten) enables perusal of 240 electronic portfolios with content-specific technology projects in early childhood, language arts, social studies, math, and science in different K–12 and university levels.

Factors that Promote and/or Influence Professional Development on Technology Integration in the Classroom

Analysis of the journal entries revealed that capacity-building activities increased participants' confidence and competence with technology tools. At the beginning of their participation, all the participants responded to a needs assessment that gauged their readiness to use technology in the classroom and identified specific areas they needed to improve. This formative data enabled the development of appropriate capacity-building activities. The needs assessment survey revealed that, at the beginning of the program, most faculty and cooperating teachers were at low to moderate skill levels in their use of advanced technological tools in their daily practice. Some faculty were assisted in creating a digitized video presentation; others were assisted in the development of online courses. Some student teacher supervising faculty were assisted in using e-mail, sending and receiving attachments, creating Web pages, using e-mail lists, and composing electronic versions of lesson plans. A large number of cooperating teachers learned about Internet search skills, multimedia creativity programs, and visual thinking tools. Analysis of the journal entries reflect that the flexible format of the activities (group workshops, small-group work sessions, and one-on-one mentoring) helped address individual needs of the participants, increasing their confidence and competence in the use of technology in the classroom. Participant observations at the networked circle meetings and analyses of the journal entries revealed that networked learning circle meetings provided critical support for teaching with technology. Creative ideas were exchanged within the circle meetings, and participants' growth was evidenced by the progress made between group sessions. Circle discussions reflected that the participants needed to look at models and talk to those who used technology in their teaching. Networked learning circles appeared to meet need for teachers to discuss in a sustained fashion their challenges and successes with technology integration.

Most of the participating student teachers were more advanced in the use of technology than their mentoring teachers; consequently the student teachers served in mentoring roles themselves regarding the use of instructional technology. In turn, MITTEN has definitely been a significant staff development initiative for cooperating teachers. They helped student teachers access technology tools within their facilities, and in some cases they even activated the involvement of school technologists. Cooperating teachers also helped student teachers link content standards with technology standards in carrying out projects and lessons with advanced teaching and learning techniques.

Most faculty increased their personal and professional use of technology by using communication devices with students, Web pages, e-mail lists, and discussion boards. Some needed considerable time and professional development to help them move beyond their traditional practice. At times, the researchers observed that it was a challenge to help some faculty give up the teacher role and to become learners, but the networked learning circles created nonthreatening environments. Seeing cooperating teachers often being mentored by student teachers in the implementation of technology provided a favorable model for participating university faculty.

DISCUSSION

The study findings indicated that over the course of the MITTEN program, project participants significantly improved their confidence and competence in technology literacy and boosted their integration of technology into the teaching and learning process. They often employed multiple forms of technology to enhance both their own teaching and students' learning. It appears that educators need to become comfortable with technology tools before they start integrating them into the curriculum. Data from the study suggest that need-based workshops, small-group work sessions, and one-on-one mentoring help educators to learn about advanced technology tools and to feel more comfortable about using them in the classroom. Data also suggest that teachers need additional support for teaching with technology. The Network Learning Community model put in place provided teachers with opportunities to learn about technology integration within the context of their teaching environment and allowed them to collaborate with others as they learned about and experimented with new technology tools. The model thus appear to offer an effective way to channel the technical and pedagogical support that participants needed when attempting to integrate technology.

Consistent with the findings of this study, the emphasis on collaborative work within an authentic setting for teacher professional development is well documented in the literature (see Cole, Simkins, & Penuel, 2002; Lawless & Pellegrino, 2007; Mulqueen, 2001). As Rhine and Baily (2005) highlight, in recent years, learning communities were at the heart of many efforts to develop effective models of technology integration. Those communities take multiple forms, with variations based on the compositions of the group, the nature of interaction, the focus of the task, and the support system in place. One common theme across most learning communities is the importance of partnership and collaboration to affect instruction. Similarly, the MITTEN project discussed in this study suggests considerable readiness for long-term collaborative training models that might produce lasting change in a school's teaching and learning culture.

IMPLICATIONS / CONCLUSIONS

The question currently challenging teacher education programs is not whether or not technology should be integrated into teacher education, but, rather, is how to integrate technology into teacher education curriculum most effectively. The first study ("Practice") presented in the Part 1 of this two-part article series highlights three critical components of technology integration into the teacher preparation programs—core course work, effective faculty modeling of instructional technology, and technology-enriched field experiences. The Networked Learning Communities (NLC) model that is presented and discussed in "Theory" section of Part 1 states a strong theoretical grounding for tying all three components of technology integration into pre-service teacher preparation programs. NLC model facilitates engagement, interaction, and collaboration among schools of education, school districts, and colleges of arts and sciences, on behalf of the pre-service teachers involved as such it undoes the kind of detachment that often prevails between the postsecondary and the K-12 educational worlds. This type of cooperative engagement among all of these entities supports addressing all critical elements of technology integration within a teacher preparation program.

Data from research on the MITTEN project ("Theory into Practice") suggests that NLC model provides a venue that fosters genuine dialogue among academicians, K–12 teachers, student teachers, and their university supervisors.
The model thereby alleviates the tendency for each of these vital participants in teacher education to remain unproductively sidelined. Engaging these diverse groups through NLCs in the project studied here enabled the development of shared meaning (Fullan, 2001)—important in reaching outcomes related to pedagogical renewal in technology education. Because this separation has been most pronounced with respect to future teachers' clinical experiences, intensified focus on the student teaching experience appears to be the key for reconnecting those engaged in teacher education. The NLC idea allowed the putting-into-place of structures and processes for such reconnection, thus encouraging networking, mutual learning, and sharing of strategies and resources. The research reported here suggests that, in these ways, the model presented can enable an effective response to the need for a more comprehensive program for the preparation of a technology-proficient K–16 teaching force.

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GENİŞLETİLMİŞ ÖZET

İki seri halinde sunulan üç ayrı çalışmanın birinci bölümünde öğretmen eğitiminde bilgi ve iletişim teknolojileri (BİT) entegrasyonu konusundaki mevcut eksiklikler tartışıldıktan sonra bu eksikliklerin giderilmesi için “bağlantılı öğrenme topluluğu” [networked learning communitiy (NLC)] olarak tanımlanan bir model önerisi sunulmuştur. “Model Uygulaması” başlığı ile burada sunulan üçüncü çalışma NLC modelinin uygulandığı [Michigan Teachers’ Technology Education Network (MITTEN)] projesinin sonuçlarını yansıtmaktadır.

Üç yıldan fazla süren MITTEN projesine 7 ayrı grup halinde toplam 246 [K-16] eğitimci katılmıştır. Her bir gurupta (a) okul öncesi , (b) edebiyat ve dil bilgisi, (c) sosyal bilgiler, (d) fen ve (e) matematik olmak üzere 5 ayrı NLC gurubu oluşturulmuştur. Genel olarak her bir NLC gurubu kendi alanında öğretmenlik uygulaması döneminde bulunan 4 öğretmen adayı, bu adayların öğretmenlik uygulamasına rehberlik eden 4 hizmet içi sınıf öğretmenive bu uygulamaları denetleyen bir adet gözetmen ve adaylara alan, yöntem ve eğitim teknolojisi derslerini veren öğretim üyelerinden oluşturulmuştur. Her gurubun projeye katılımı iki öğretim dönemi sürmüştür. Bu süre içerisinde her gurup birbirini destekleyen üç farklı etkinliğe katılmıştır. Birinci dönemde katılımcılar istek, ilgi ve ihtiyaçları doğrultusunda küçük guruplar halinde BİT ile ilgili çalıştaylara katılmışlardır. İkinci dönemde her bir katılımcının öğrendiği teknolojileri öğretme ve öğrenme ortamlarında kullanabilmesi amacıyla proje hazırlamasına ve bu projeleri gerçek sınıf ortamlarında uygulamasına olanak sağlayan ortak öğrenme gurupları [networked learning circles] oluşturulmuştur. Bu etkinlikler süresince bütün katılımcılar ayrıca seminer faaliyetlerine katılarak sınıf içi teknoloji kullanımı, bu süreçte gündeme gelebilecek sosyal ve kültürel konular ile sınıf içi değişiklikler konusunda bilgi edinmişlerdir. Her bir katılımcı proje süresince hazırlayıp uyguladığı teknoloji destekli ders ve ünite planlarını,bunlarla ilgili bilgi, belge ve değerlendirmelerini içeren bir elektronik portfolyo hazırlamış ve hazırladığı e-portfolyoyu İnternet ortamında sunmuştur.

MITTEN projesi süresince aşağıdaki araştırma sorularına cevap aranmıştır:

1. NLC modelinin [K-16] eğitimcilerinin BİT hakkındaki bilgilerine ve bu teknolojileri öğretme ve öğrenme ortamlarında kullanma konusundaki güven ve becerilerine katkısı nedir?
2. [K-16] eğitimcilerinin BİT'e ilişkin bilgilerini ve BİT'in öğretme ve öğrenme ortamlarında kullanımı konusundaki güven ve becerilerini ne tür öğrenme etkinlikleri etkilemektedir.

Yukarıdaki soruları yanıtlamak için, verilerin toplanması ve çözümlenmesinde nitel ve nicel araştırma yaklaşımlar birlikte kullanılmıştır. Araştırmaya 105 öğretmen adayı, 105 hizmet içi öğretmen, 8 gözetmen, ve 28 öğretim üyesi katılmıştır. Nicel veriler, ön test /son test tekniği kullanılarak anket yoluyla toplanmıştır. Nitel veriler ise değerlendirme anketi, katılımcı günlükleri, araştırmacıların ortak öğrenme gurup toplantıları sırasında tuttukları notları ve katılımcıların elektronik portfolyolarında sundukları bilgi ve belgelerden elde edilmiştir. Elde edilen nicel veriler ilişkili örneklemler için t-testi [paired-samples *t* test] ; nitel veriler ise içerik analizi tekniği kullanılarak çözümlenmiştir.

Elde edilen bulgular doğrultusunda, programa katılan eğitimcilerin genel BİT kullanımı bilgileri ile BİT'lerin öğretme ve öğrenme ortamlarında kullanımına yönelik güven ve becerilerinin önemli ölçüde arttığı ortaya çıkmıştır İlişkili örneklemler için t-testi sonuçları bütün anket maddelerinde istatistiksel olarak anlamlı bir farklılaşmanın olduğunu göstermektedir. Elde edilen nitel veriler de bu sonucu destekler niteliktedir. Projeye katılan eğitimcilerin çoğunluğu hazırlayıp uyguladıkları teknoloji destekli ders ve ünite planları ve bunlarla ilgili değerlendirmelerini elektronik portfolyolarında sunmuşlardır. MITTEN projesi Web sayfasında (http://www.umd.umich.edu/mitten) bu çalışmaları içeren 240 elektronik portfolyo bulunmaktadır.

İkinci araştırma sorusuna ilişkin bulgular katılımcıların ilgi, istek ve ihtiyaçları doğrultusunda küçük guruplar halinde gerçekleştirilen BİT çalıştaylarının katılımcıların çoğunun BİT konusundaki bilgi ve becerilerini arttırdığını buna karşın BİT'in öğretme ve öğrenme ortamlarında kullanımı konusundaki güven ve becerilerin ise ortak öğrenme gurup toplantılarında kazanıldığını göstermektedir.

Bulgular aynı sınıfta birlikte çalışma fırsatı bulan öğretmen adayları ve bu adaylara rehberlik eden hizmet içi sınıf öğretmenlerinin BİT'in öğretme ve öğrenme ortamlarında kullanımı konusunda birbirlerini tamamlayıcı bir rol oynadıklarını göstermektedir. Uygulama dönemindeki öğretmen adaylarının BİT kullanımı konusunda genelde hizmet içi öğretmenlere göre daha bilgili olduğu gözlenmiştir. Buna karşın hizmet içi öğretmenler öğretim programları ve yöntemleri konusunda daha tecrübeli olduklarından bu iki gurubun birlikteliği BİT'in sınıf içi kullanımı konusunda birbirlerini tamamlayıcı bir ortam hazırlamaktadır.

Bulgular, araştırmaya katılan öğretim üyeleri ve öğretmenlik uygulamalarını denetleyen gözetmenlerin (genelde emekli öğretmenlerden oluşmakta) bir çoğunun BİT'i kendi alanlarında kullanma konusunda projeler geliştirerek ilgili uygulamaları elektronik portfolyolarında sunduklarını göstermektedir. Bununla birlikte özellikle mesleğin ilerleyen yıllarındaki bazı öğretim üyeleri ve gözetmenlerin gerekli gelişim ve değişimi gösterebilmek için daha fazla zaman ve desteğe ihtiyaç duydukları gözlemlenmiştir. Dahası bu guruptan bazı katılımcıların NLC ortamının çoğu zaman gerektirdiği "öğretmen" kimliğinden sıyrılıp "öğrenci" kimliğine bürünmekte zorluk çektikleri ortaya çıkmıştır.

Elde edilen bulgular doğrultusunda MITTEN projesi süresinde uygulan NLC modelinin [K-16] eğitimcilerin BİT hakındaki bilgilerine ve BİT'in öğretme ve öğrenme ortamlarında kullanımı konusundaki güven ve becerilerine önemli ölçüde katkı sağladığı sonucuna ulaşılmıştır. Bulgular eğitimcilerin öncelikle BİT konusundaki çekincelerini aşmak istediklerini gçstermektedir. Eğitimcilerin bireysel ilgi, istek ve ihtiyaçları dogrultusunda sunulacak olan bilişim teknolojileri ile ilgili küçük-guruplu öğrenme çalıştayları bu ihtiyacın karşılanmasına cevap vermektedir. Eğitimciler BİT'in öğretme ve öğrenme ortamlarında kullanımı konusunda daha fazla ve çok yönlü bir eğitime ihtiyaç duymaktadırlar. MITTEN projesi çerçevesinde sunulan ve [K-16] eğitimcilerinin gerçek sınıf ortamlarında birlikte çalımalarını ve sınıf içi teknoloji kulanımını birlikte öğrenmelerini destekleyen NLC yaklaşımı bu ihtiyacı karşılamaktadır.

Öğretmen eğitimi ile ilgi en güncel konulardan BİT'in öğretmen yetiştirme programlarına nasıl entegre edilmesi gerektiğidir. Birinci seride "Mevcut Uygulamalar" başlığı ile sunulan ilk araştırmada teknoloji becerileri ile donanmış yeni nesil öğretmenlerin yetiştirilmesinde kritik öneme sahip üç faktöre dikkat çekilmiştir. Yine ilk makalede "Teori" başlığı altında sunulan ikinci çalışmada "bağlantılı öğrenme topluluğu" [networked learning community (NLC)] olarak tanımlanan bir model önerisi geliştirilmiş ve bu modelin uygulaması sonucunda ilk araştırmada ortaya çıkan üç önemli faktörün öğretmen eğitimine entegrasyonunun sağlanabileceği tartışılmıştır. Burada sunulan ve "Teori Uygulaması" başlığını taşıyan bu üçüncü araştırma, NLC modelinin uygulamaya konduğu MITTEN projesinin sonuçlarını içermektedir. Bulgular hizmet öncesi ve hizmet içi öğretmenler ile öğretmen eğitimiyle ilgili öğretim üyeleri ve öğretmenlik uygulaması gözetmenlerinin birlikte ve ahenkli çalışmalarını gerektiren NLC modelinin ortaya koyduğu yaklaşımın her bir gurubun BİT'e ilişkin bilgilerine ve BİT'in öğretme ve öğrenme ortamlarında kullanımı konusundaki güven ve becerilerine önemli ölçüde katkı sağladığını göstermektedir. Normalde birbirinden bağımsız çalışan bu gurupların NLC modeli çerçevesindeki birlikteliği Fullan'ında (2001) işaret ettiği gibi onların ortak bir amaç etrafında birleşmelerini sağlamış ve bu yolla da BİT'in öğretmen eğitimine entegrasyonu konusunda gerekli olan pedagoji değişimine olanak tanınmıştır.