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Preparing Pre-Service Teachers to Integrate Technology: The Utility of the Intel "Teach to the Future" Program

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ABSTRACT

Pre-service teachers often do not possess the necessary skills, knowledge and experiences to effectively use technology for instruction and learning in their classrooms. This is due in part to the inexperience of many education faculty in integrating and modeling the use of technology in their courses. Finding ways to address this gap in skills has proven challenging for teacher education programs. This paper explores the process utilized by one university to begin to remedy this problem through the Intel "Teach to the Future" Pre-Service Program. The curriculum is both described and critiqued using results from a survey of education faculty participating in this 4 day program. While the overall evaluation of the program was quite positive, program participants offered many suggestions to improve the program curriculum. The success of this pre-service program has led to further discussions of implementing components of this program curriculum into several courses, and a commitment to host the Intel in-service for K-12 teachers and the Intel Leadership Forum for K-12 administrators in 2005.

INTRODUCTION

Pre-service teachers often do not possess the necessary skills and knowledge to effectively integrate technology into instruction and learning in their classrooms. A report by the Office of Technology Assessment (1995) concluded that:

> ...technology is not central to the teacher preparation experience in most colleges of education in the United States today. Most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice...most technology instruction...is teaching about technology...not teaching with technology across the curriculum (p. 165).

A national study (Milken, 1999) found that, "in general, teacher-training programs do not provide future teachers with the kinds of experiences necessary to prepare them to use technology effectively in their classrooms...The conclusion is that teacher education...is not preparing educators to work in a technology-enriched classroom" (p. 978).

The lack of appropriate experiences in technology use at the pre-service level has had a trickle-down effect on K-12 teachers. Studies demonstrate that K-12 teachers struggle to effectively use technology in their classrooms (NCES, 2000; US DOE, 2000). Less than 20% of U.S. K-12 public school teachers felt adequately prepared to use computers and the Internet for their teaching (NCES, 2001). In addition, only 44 percent of new teachers (3 or fewer years) were well prepared to use technology.

Many teacher education programs fail to provide the necessary training to properly prepare pre-service teachers to integrate technology in the classroom. This failure is due in part to the inexperience of education faculty in technology integration—education faculty do not effectively model technology as an instructional tool nor do they teach their students how to utilize technology to instruct (OTA, 1995).

The teacher education program at our university is no exception. We hoped to address this by providing training to interested education faculty on the appropriate and effective integration of technology in their courses. To this end, we employed the assistance of Intel and their free "Teach to the Future" pre-service program which included an Intel trainer and 4 days of hands-on training, a pre-service teacher curriculum, electronic resources, and ongoing support for education faculty. This paper explains our decision process to adopt the Intel program, shares feedback from faculty at other institutions who had completed this program, describes the curriculum, presents our perceptions of this curriculum and the training measured by survey responses of participants, and lastly, discusses our next steps.

REVIEW OF LITERATURE

In the mid-1990s, surveys of first year teachers suggested that many of them feel inadequately prepared to use technology once they enter the classroom (Strudler, Quinn, McKinney, & Jones, 1995; Topp, Thompson, & Schmidt, 1994; OTA, 1995). In addition, a 1995 national survey of recent graduates with an average of 2.8 years of teaching experience discovered that more than 50% of these teachers felt unprepared or poorly trained to teach with technology (Colon, Willis, Willis, & Austin, 1995). This was compounded by a lack of access to technology in the schools and in particular, access to the Internet (NCES, 2001). In 1994, only 35% of US K-12 schools had Internet access and only 3% of instructional classrooms. In 2000, although 98% of US K-12 schools had Internet access and as many as 77% of instructional classrooms, teachers were still unprepared to use technology effectively—a mere 30% used the Internet for student research, 27% to analyze data or solve problems and only 16% used technology for lesson planning (NCES, 2001).

A number of factors contribute to the poor state of technology integration in K-12 schools. A lack of effective preparation at the pre-service level is one of the most important obstacles to the use of technology in schools (Mowrer-Popiel, Pollard, & Pollard, 1994).

Having technology skills and experiences have long been considered prerequisite skills for future teachers (Hixson & Jones, 1990; Wood & Smellie, 1991). Researchers and educators alike strongly believe that technology should be included in teacher education programs (Fontana & Ochoa, 1985; OTA, 1995). This justification often rests on the assumption that future students of these pre-service teachers will require technology skills to perform on their jobs in the Information Age (Burnett, 1994; Kerka, 1994) and that technology is a necessary instructional tool and resource for teachers.

There are two major approaches to teaching pre-service students the effective use of technology. The first approach, the "inoculation" method, is to provide technology instruction in the form of a stand-alone course. This is, by far, the more popular approach—as many as 85% of teacher education programs employ this method (Milken, 1999). The second approach is the use of technology—"infused" in the methods and curriculum courses.

The "inoculation" method offers a single course to provide pre-service students with the necessary technological knowledge and skills to use in the classroom; the assumption is that the

computer skills acquired in this "single dosage" course will translate into powerful technology use in the classroom (Carr & Bromley, 1997). Newren, Waggener, and Kopp (1991), described the objective of such a course:

> ...is to socialize pre-service teachers so that they will become comfortable, confident, competent, committed, and creative users of instructional media and technology...students, upon completion of this course will be capable of solving instructional problems for which a mediated intervention can be a successful solution...as well as being knowledgeable and capable of recommending the acquisition of new media and technologies for addressing learning problems for which they are confronted (p.8-9).

However, many contend it is inconceivable that pre-service teachers will be able to use computers or integrate technology in the curriculum after taking a single technology course (Jensen, 1992). A single course may incorrectly imply to students that computers are add-ons and not an integral part of a vast array of instructional resources (Fox, Thompson, & Chan, 1996).

The second approach, the "infusion model," a more difficult and complex one to implement, integrates technology in all or most of the education courses, particularly the methods courses. (Topp, Thompson, & Schmidt, 1994). A powerful reason to integrate technology across the curriculum is that pre-service teachers should have hands-on experience within the context of their entire teacher education so that they can develop a range of skills and construct robust mental models related to technology integration. This infusion model is thought to better facilitate learning because it provides opportunities to use technology both as an instructional resource and as a tool (Thomas, Larson, Clift, & Levin, 1996). In fact, computer skills modeled in methods courses have been found to be significant predictors of actual computer use in the field (Handler, 1993). A number of studies have documented the importance of faculty using technology for instruction directly related to subject matter (Brownell & Brownell, 1991; Schmidt, Merkley, Strong, & Thompson, 1994). Sadly, faculty of methods courses are not always experienced in using educational technology within their particular curriculum areas, nor are they always familiar with current software (White, 1994).

The Role of Faculty in Teacher Education Programs

Considering most pre-service teachers have little in-depth knowledge about pedagogy, instructional design, and technology when beginning teacher education programs, it is imperative that these pre-service teachers are given an instructional model to emulate (Sheffield, 1996). The vast majority of education faculty do not effectively model technology as an instructional tool nor do they teach their students how to utilize technology to instruct (OTA, 1995). Of those that do instruct with technology or on technology use, most of their instruction focuses on outdated, older forms of computer technology and less on the newer, and more sophisticated technological tools that are known for their abilities to tap students' higher order thinking skills and problem solving skills (Baron & Goldman, 1994; OTA, 1995). Faculty must act as active role models for pre-service teachers showing them how to harness the new technological developments into the teaching/learning process and to use technology both in the presentation of instruction and lesson development (Denee, 1990). Effective modeling of technology by education faculty and supervising teachers is essential to pre-service teachers (Widmer & Amburgey, 1994) particularly because of the natural inclination to teach the way we were taught. The attitudes of teacher education faculty toward the use of technology in the classroom will have a strong impact on the implementation of technology by pre-service teachers (Barker, Helm, & Taylor, 1995; Handler, & Marshall, 1992; Munday, Windham, & Stamper, 1991).

Pre-service teachers form images of classrooms based on their own experiences as students in their K-12 settings (based on thousands of hours of classroom exposure over 13 years) (Calderhead & Robson, 1991; Clark, 1988). However, technology has not been a staple in the K-12 setting in most schools until recently;

most images that pre-service teachers possess would largely exclude technology experiences. Helping pre-service teachers acknowledge, reflect upon, and even modify these long-held beliefs is one of the most important challenges of teacher education programs. Thus, teacher education programs should not reinforce existing images based on out-dated views (Serow, Eaker, & Forest, 1994) – these programs should help education faculty focus on innovative and practical uses of technology in the classroom to support instruction and learning.

Some of the reasons education faculty do not integrate technology in their courses include: time constraints, anxiety, and a lack of knowledge about how to integrate technology and classroom applications (Becker, 1994; Gilmore, 1995; Hunt & Bohlin, 1993). Administrators can support faculty in helping them to use technology as an instructional tool by providing them professional development opportunities, offering incentives and rewards for faculty who effectively employ technology and by providing needed technical support (Ennis & Ennis, 1996).

Our Context

Our 4 year, mid-sized, regional, comprehensive public university is situated in the Northwest United States. The Department of Education at our university supports one of the largest teacher preparation programs in the state certifying close to 550 teacher candidates each year. The "inoculation" method is our approach to teaching pre-service students the effective use of technology. All education students are required to pass a 3 credit Educational Technology course. This course is designed to give them an overview and hands-on experiences with educational technology concepts, skills and knowledge based on the National Educational Technology Standards for Teachers (NETS-T). Informal conversations with department of education administrators, faculty and students indicate that many education faculty (other than those teaching sections of the Educational Technology course) are not adequately using or effectively modeling technology use in their instruction. To address this issue, our Educational Technology Center has begun offering faculty development opportunities to education faculty related to educational technology with the goal of more effective use and modeling of technology for their pre-service students. Offering the Intel "Teach to the Future" Pre-Service Program was one such opportunity.

THE INTEL TEACH TO THE FUTURE PRE-SERVICE PROGRAM

Intel's description of their program is as follows:

> The Intel Teach to the Future Pre-Service Program has been designed to provide hands-on instruction for future teachers about sound methods of using technology as a tool for teaching and learning. At its core, this project is about pedagogy. Intel Teach to the Future Pre-Service Program was designed to address the challenges that future teachers will face in effectively applying computer technology to enhance student learning. At the completion of the Intel Teach to the Future curriculum, pre-service teachers will have created a teaching unit for a P-12 classroom that engages students and helps them attain state and national standards. All elements of this unit are saved in a well-documented Unit Portfolio.

Intel's program is a component of their philanthropic efforts and as a result, they cover all costs including faculty curriculum binders, training materials, and training costs. In exchange for this, universities or faculty are responsible for:

1. Planning which courses would use the Intel Teach to the Future curriculum.
2. Any travel costs incurred to participants to attend the 4 days of training.
3. Using the curriculum (at least in part) with at least 25 pre-service teachers for each faculty member who attends training.
4. Submitting online reports 4 times a year indicating how many pre-service teachers they have used the material with and any comments they wish to share.

https://pdxscholar.library.pdx.edu/nwjte/vol4/iss1/3
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More than 1.5 million teachers in 30 countries have completed the program (110,000 teachers in 46 states in the U.S.) since its inception in 2000. A formative evaluation of this program by the Center for Children & Technology (CCT) was very positive (see http://www2.edc.org/cct/publications_report_summary.asp?numPubId=149).

A review of the curriculum and accompanying information included additional questions handled via phone and e-mail and contact with education faculty at other Colleges of Education in the U.S. who had completed the programs. A faculty member at Texas State University-San Marcos wrote:

> We received a PT3 grant in 2001, which has greatly helped in our efforts to enhance our program by providing professional development opportunities to our faculty and assisting in the implementation of technology in our field-based courses. Intel became a partner with us on this effort in our second year of the grant. The majority of our faculty who teach in the field have been through the training and their students are now engaged in designing pedagogically sound units of study that are enhanced with technology-based projects such as PowerPoint slide shows, desktop published products, and web pages.
>
> I can say with confidence that the Intel Teach to the Future program has made an enormous difference in the quality of our pre-service program. Our students, and our faculty, are much more confident in their knowledge and use of technology than they were three years ago.
>
> The only drawback is that as students and faculty become more proficient, their need for equipment grows. Unfortunately, we do not have the funds to equip our field-based sites as we would like to do. Of course, we are always in search of grants or other sources of income to help us.

The other response was from the chair of Secondary Education at Cal State Fullerton who wrote:

> I believe that use of the Intel Teach program has transformed the Single Subject Credential Program at CSU Fullerton....Having trained 30 faculty now, I'm also seeing new kinds of assignments in other courses in the credential program i.e., prerequisite students in our Adolescence course may be assigned a multimedia presentation project instead of a lengthy research paper; prerequisite students in our Diversity course may be assigned a brochure of a disability in lieu of a paper. So as my instructors model these kinds of assignments, our candidates see how to make it work in classroom settings.
>
> We've set a standard for our faculty and students now and we consider ourselves to be a "PC, MS Office" department and program and require all students to have access to and utilize MS Office which is great because we've put some of our prerequisite courses online and students submit documents electronically.
>
> My department is considered to be the most advanced technologically in the School of Education. We've also learned to make templates and forms through the training and I'd say that as chair, that has been one of the best things I've ever learned!

With these endorsements and a positive review of the Intel curriculum, administrators in our Department of Education fully supported this initiative and provided a stipend for all program participants and additional funds to cover travel expenses for faculty traveling from out of town to attend this program. An e-mail invitation was sent out in September 2004 to all education faculty describing the program and the incentives. Although initially a considerable number of education faculty were interested, the timing and the four day commitment (two of which included Saturdays) limited the number of faculty who registered. In the end, sixteen faculty registered, and nine showed up and completed all four days of training.

Intel Program Schedule

The Intel Program involved training for four full days in a PC lab. Intel informed us that if

the travel costs for the Senior Trainer were low, these four days could be divided into two sessions which would need to be completed within 30 days. Based on faculty and administrator input and Intel's schedule on best days/dates to conduct the training, the training was scheduled on two consecutive Friday/Saturday combinations. Each training day ran for 7 hours, from 8:30 AM -4:30 PM with a 1 hour break for lunch.

Participants

The nine participants involved in the Intel Program were faculty members in the Department of Education at our institution. These participants represented a number of different content areas including special education, educational technology, educational foundations, library media, English education, and curriculum methods. The ranks of the participants included three full professors, three assistant professors, and three adjunct professors.

The Intel Teach to the Future Pre-Service Program Curriculum

The Intel Teach to the Future Curriculum was prepared by the Institute of Computer Technology (ICT) and the Intel Corporation with support from Microsoft. The Intel trainer indicated that the curriculum was continually being revised based on participants' feedback, and we were encouraged to offer input and suggestions for change.

The Intel Teach to the Future Program manual (Faculty Edition 2.1) we used for the program contained 10 modules and a companion CD-ROM complete with activities, templates, and student samples to support the curriculum. All modules were set up similarly. Each module began with a section identifying the objectives, the needed tools (software and curriculum materials) and guiding questions for the module. This section was followed by the "class preparation checklist" which listed the required and optional resources. The "Overview" page outlined the 4 areas all modules addressed, specifically – "Pair and Share," "Pedagogical Practices," "Activities" and "Homework Activity." The "Overview" page was followed by detailed directions on how to use the required software to complete the activities. All the content and activities in the curriculum manual were also available electronically via the CD-ROM—participants were allowed to customize and tailor the electronic documents to meet their needs. (Note: The step-by-step guides in our curriculum manual were specific to the version of MS Office that participants were using. In our case, we were using MS Office XP and therefore our manual included directions in using MS Office XP applications.)

The program was designed to allow participants to advance through the curriculum as preservice students and as K-12 students and build a technology-infused unit and electronic unit portfolio. Participants were encouraged to bring their own K-12 resources in order to develop a unit to that would be aligned to their teaching needs. The idea was for participants to develop samples of K-12 student work in order to later model for their pre-service students the kinds of products that their K-12 students might create. With the assistance of the Intel trainer, the participants would be asked to periodically stop their work and reflect and share some of the issues or concerns and pedagogy involving some of the content and concepts. Because this 4 day program was meant to serve only as an overview of the curriculum, participants did not have time to complete all sections of the curriculum but were at least exposed to much of the material in each area.

SURVEY RESULTS

Feedback from participants was gathered informally in discussions and formally through surveys submitted via e-mail and fax to our Educational Technology Center director following the completion of the program. The survey consisted of 7 open-ended, short-answer questions asking participants about their impressions of the trainer, the training, and the curriculum. Seven out of nine of the participants completed surveys.

The surveys showed that all participants thought the Intel trainer was very effective in facilitating the program. He had provided training to dozens of institutions over the last few

years, and appeared quite versed in the curriculum and in his ability to deliver it. Below are some of the participants' survey comments about the trainer:

> The instructor was personable, knowledgeable, and a great facilitator.

> He paced the class well, accelerating lessons when necessary...he raised important pedagogical questions...and answered questions thoroughly.

> Instructor came across as very knowledgeable...seemed to enjoy his work, and modeled effective instructional strategies.

Several participants believed that a different training schedule would have been more effective:

> The suggestion of a "broken" workshop, punctuated by two weeks with e-mail reminders from the presenter, would better align with a distributed practice approach to learning.

> For me, I think the "broken model" with two weeks in between would have been more useful, because I would have had the extra week to review and practice some of the steps...It would also have the advantage of not having to commit two weekends back-to-back for the training.

Many of the survey respondents found the curriculum and the manual format useful:

> Very well designed, easy to navigate both CD and notebook. Step-by-step instructions easy to follow.

> The materials in our book was very useful...it appears to be well organized and thought-out. We were told that it is the result of feedback from teachers, and I think the quality is reflected by this effort.

> I think having this resource as a reference will be useful to me in the future, both to act as a review to the steps and procedures that we did in class, and as a way to learn and cover the areas that we had to skip. It seems to me to be a practical way to learn the material.

> I liked that we saw the pedagogy first and then had the learning followed by lots of examples on the CD and in the manual.

> Great resources and materials for us to use!

One participant questioned the currency of the copyright information presented in the curriculum:

> I teach copyright issues to my students. Those PowerPoint slides were outdated!

The copyright information presented on the PowerPoint slides was three years old and much of the information was no longer current. As we discussed the slides in class, several of the participants challenged the accuracy of some of the information and informed the class of the correct information. The trainer told us that the copyright information would be updated in the next revision of the curriculum due out in spring of 2005.

Another participant questioned the quality of the student samples presented in the curriculum:

> I wonder about the quality of the student units I saw. For example, the project on the *Scarlett Letter*—is it an improvement over some other report format? I wonder about the documentation in that project. Most of it was linear and it sounded encyclopedic.

Several of the respondents were concerned by the MS Office-centric and PC focus, and the lack of exposure to the National Educational Technology Standards for Teachers:

> I thought the curriculum was not very well laid out in terms of teaching about the ISTE standards and technology ...the curriculum is really an MS Office manual.

> I would have introduced the NETS first, followed by ways of addressing the different standards, and then moved on to using Office to accomplish these standards.

> One module is dedicated to creating websites using Publisher. Publisher is not available

on the Mac—what am I supposed to do??

> For a program that has been reviewed and endorsed by ISTE as aligned to the NETS-T, it's odd that there is no mention of these standards in the curriculum or how the curriculum components are aligned to different elements of it.

All of our classrooms in our education building have only Macintosh computers for instruction. Many of our faculty use Macintosh computers in their offices. In addition, all but one section of our Educational Technology course for pre-service students is taught on the Macintosh computer (since many of our K-12 schools in the area use Macs). The website module of the Intel program uses MS Publisher, which is only available on the PC. In addition, all the step-by-step guides in the program manual are based only on the PC versions of MS Office. Understandably, this was a problem for a number of our participants—to modify this curriculum for students and faculty on Macintosh environments would require considerable effort and work. Currently, the curriculum manual is only available for PC use.

The curriculum is MS Office-centric—programs used to access resources on the CD-ROM (templates, content, student samples and curriculum activities, and curriculum assignments) included MS Word, MS Publisher, MS PowerPoint, MS Excel, and MS Internet Explorer. As this program is developed by Intel and supported by Microsoft, the focus Office/PC predominance is expected, but limiting to pre-service students who wish to develop a richer and broader understanding of available technology programs and develop skills in them. The program was designed to assist participants in developing and furthering their skills in using MS Office programs. Some participants found this exciting while for others, it proved tedious. For example, we spent about 4-5 hours with PowerPoint focusing on both basic and advanced features. Two participants had never used PowerPoint before. One of these participants exclaimed, after several hours of learning how to use PowerPoint,—"I created my first PowerPoint presentation!" Another participant, well versed in PowerPoint, had completed the task in a relatively short time and appeared quite bored. This variety of reactions is understandable and expected considering the range of technology competencies among participants.

The back cover of the program manual indicates that ISTE (the organization that developed the NETS-T) reviewed the program curriculum in 2003 and found that in terms of the National Educational Technology Standards for Teachers alignment, the program met 1A, IIA, IIB, IIC, IID, IIE, VC, VIA and support significant growth for IIIC, IIID, VIE. Beyond this statement, there is no mention of these standards anywhere in the curriculum or index or even a listing of what they are. Most of the education faculty who participated in this program were not familiar with the six NETS-T nor their significance. This program curriculum would have been an excellent opportunity to introduce these standards, their significance and then use them as a framework for teaching the curriculum topics, and showing how various topics align with different standards. The Educational Technology course in our teacher education program uses this model and our pre-service students often comment that using this framework justifies to them why we are teaching particular topics in educational technology.

CONCLUSION

How effective and successful was the Intel Program in effecting change in these faculty participants and ultimately in our teacher education program? In spite of the shortcomings and concerns shared by the participants in their surveys, the program, by all measures, was a success. The participants involved in teaching the methods classes have talked about making a few changes in their courses in the next academic quarter including the adoption of a unit plan template from the Intel program. The participants involved in the educational technology courses have met and talked about what changes could be made to improve them based on components of the Intel program. Several of the faculty have even ordered Intel pre-service student manuals for their courses (free of charge). Furthermore,

following the training several of the participants have asked to meet collectively to sustain the momentum and interest achieved in this program and to discuss future steps. In addition, our Educational Technology Center has agreed to co-host the Intel Inservice Program in the summer of 2005 with our English Education department for K-12 teachers involved in our State Writing Project. Finally, we will be hosting a 4 hour Intel Leadership Forum for K-12 administrators in the area in the spring of 2005.

We believe these are all small, but important steps in the right direction. We also understand that systemic change takes time, and it will be some time before we can observe any changes in our education faculty's ability to teach and model using technology and finally our students' skills in effectively integrating technology in the classroom. As Craig Barrett, the CEO of Intel states on the back cover of the curriculum manual:

> The scope of this program represents our industry's recognition that all the educational technology is worth nothing if teachers don't know how to use it effectively. Computers aren't magic, teachers are.

We believe the magic has begun in our teacher education program.

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