DOCUMENT RESUME

ED 478 067 TM 035 007

AUTHOR	Hawley, Helen; Benavides, Otto; Duffy, Sharon; Georgi, David; Guay, Diane; Redmond, Pamela; Richmond, James
TITLE	StarTEC: A Technology Project in Education Reform.
PUB DATE	2003-04-00
NOTE	42p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, April 21-25, 2003).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC02 Plus Postage.
DESCRIPTORS	Educational Change; *Educational Technology; Higher Education; Program Descriptions; Program Effectiveness; *Teacher Education; Technology Education; *Technology Integration
IDENTIFIERS	*California

ABSTRACT

StarTEC (Staff, Teacher, and Restructured Technology Education Consortium) was a 3-year technology catalyst program funded by the U.S. Department of Education, and continued for a third year to complete its activities. The goal of StarTEC was to ensure that all teachers prepared by partners in the Consortium would meet the new California standard in technology required for the California Preliminary Teaching Credential or the Professional Clear Credential.This document describes the StarTEC project and draws some lessons for the integration of technology in higher education. Some case studies illustrate StarTEC activities: (1) the University of California, Riverside: Collaboration through Technology; (2) California State University, Fresno: Changing Culture; (3) California State University, Bakersfield: Education Technology Certification System; and (4)University of San Francisco: Using Technology as an Assessment Tool. The anecdotal evidence collected on these training programs though evaluation surveys shows that StarTEC can contribute to the field of technology integration through an increased understanding of the complexities of higher education reform related to technology integration and the key elements of effective technology training plans. Attachments include a discussion of the evolution of the Thought and Practice aspect of the Apple Computer initiative, a discussion of Sparrow Web software, and the new technology standards matrix. (SLD)

StarTEC: A Technology Project in Education Reform.

Hawley, Helen; Benavides, Otto; Duffy, Sharon; Georgi, David; Guay, Diane; Redmond, Pamela; Richmond, James

This paper is prepared for the:
Annual Meeting of the American Educational Research Association in Chicago, IL
April 2003

StarTEC: A Technology Project in Education Reform

Helen Hawley
California Commission on Teacher Credentialing

Otto Benavides
California State University, Fresno

Sharon Duffy
University of California, Riverside

David Georgi
California State University, Bakersfield

Diane Guay
Notre Dame de Namur University

Pamela Redmond
University of San Francisco

James Richmond
California State University, Chico

EXECUTIVE SUMMARY

StarTEC (Staff, Teacher, and Restructured Technology Education Consortium) was a three-year technology catalyst program funded by the United States Department of Education Preparing Tomorrow's Teachers to use Technology (PT3) Program. StarTEC completed its third year in 2002 and is currently exercising a one- year extension option to complete obligated acitivities. The single overriding goal of the StarTEC project was that *all future teachers prepared by the Consortium's Institutions of Higher Education partners would meet the new California standard in technology required for the California Preliminary Teaching Credential and/or the Professional Clear Credential.* The purpose of this paper is to document the StarTEC project and draw some analyses for successful integration of technology in higher education.

StarTEC was coordinated through the leadership of the California Commission on Teacher Credentialing (CCTC). Six Colleges of Education (COE) participated, three of which were original partners and three that were added in years two and three. University of California, Riverside, Notre Dame De Namur University, and California State University, Fresno were part of the original proposal. California State University, Bakersfield joined the project during the 2000-2001project year. California State University, Chico and University of San Francisco became partners in the third year of the project. The StarTEC partnership also included two primary training partners (Apple

Technology Standard and receive full accreditation for their teacher preparation program. The standard for the California Preliminary Credential is as follows:

> Through planned prerequisite and/or professional preparation, each candidate earns and begins to use appropriately computer-based technology to facilitate the teaching and learning process. Each candidate demonstrates knowledge of current basic computer hardware and software terminology and demonstrates competency in the operation and care of computer related hardware. Each candidate demonstrates knowledge and understanding of the appropriate use of computer-based technology for information collection, analysis and management in the instructional setting. Each candidate is able to select and evaluate a wide array of technologies for effective use in relation to the state-adopted academic curriculum.

Program Standard Elements: Using Computer-Based Technology in the Classroom:

a) Each candidate considers the content to be taught and selects appropriate technological resources to support, manage, and enhance student learning in relation to prior experiences and level of academic accomplishment.
b) Each candidate analyzes best practices and research findings on the use of technology and designs lessons accordingly.
c) Each candidate is familiar with basic principles of operation of computer hardware and software, and implements basic troubleshooting techniques for computer systems and related peripheral devices before accessing the appropriate avenue of technical support.
d) Each candidate uses computer applications to manage records and to communicate through print media.
e) Each candidate interacts with others using e-mail and is familiar with a variety of computer-based collaborative mechanisms.
f) Each candidate examines a variety of current educational technologies and uses established selection criteria to evaluate materials, for example, multimedia, Internet resources, telecommunications, computer-assisted instruction, and productivity and presentation tools. (See California State guidelines and evaluations).
g) Each candidate chooses software for its relevance, effectiveness, alignment and content standards, value added to student learning.
h) Each candidate demonstrates competence in the use of electronic research tools and the ability to assess the authenticity, reliability, and bias of the data gathered.
i) Each candidate demonstrates knowledge of copyright issues and of privacy, security, safety issues and Acceptable Use Policies.

Six objectives were designed for StarTEC in alignment with state and national standards to develop a teacher education program that effectively integrates technology.

Objective 1 requires state approval of a technology plan for each teacher preparation program according to the CCTC Technology Standard.

Objective 2 addresses the increased use of technology within the COE partners' teacher preparation courses.

Objective 3 relates to the development of a vision at each COE for the future of technology in teacher education.

Objective 4 focuses on the technology competency of preservice teachers.

Objective 5 relates to the transfer of education technology to the K-12 classroom through summer schools or academies.

Objective 6 addresses the dissemination of StarTEC results to other teacher education programs throughout the state and nation.

PROJECT BACKGROUND

The StarTEC Project began with goals set by the sponsoring agency responsible for teacher quality in California, CCTC. With a new level of expectation for teachers as a result of sweeping legislative reform, CCTC folded technology competence into a reform policy that includes technical expert assistance from state-trained experts and consultants. The efforts of StarTEC blended with the state restructuring of teacher preparation fulfill the catalytic charge of the grant obligations.

Lessons Learned 1999/2001

The project began with simplistic expectations that the COEs involved would all essentially reach the goals in the same ways, an approach that was essentially quantitative. In other words, how many education faculty could the project train in technology integration in three years with the assumption that the numbers trained would change education culture. When the COE partners reported their progress at the end of the first year, the clear fallacy of assumption was three-fold.

a) The first false assumption was that institutions with different cultures would make a paradigmatic shift in the same way. The COE partners ranged in size from very large to very small; their cultures ranged from religious to state institutions; their demographics represented different cultural and regional attitudes; and their technology resources varied from virtually none to state of the art in technology.
b) The second false assumption was that education faculty would desire to participate in the project for extrinsic rewards. The grant provided for every participant to receive a stipend and cost-free services; however, most felt that their other professional demands such as research for publishing, committee and governance responsibilities, and teaching could not be compromised for a relatively small sum of money. In other words time to participate and make changes became a primary obstacle. Some faculty felt no need to use technology because they believed that their traditional methods were adequate, and they did not understand the state requirement to implement the technology standard.

c) The third false assumption was that a single model of integration would meet the needs of all who participated. The skills and abilities of education faculty varied from beginner to intermediate. Because the original training model began with a skills-based "boot camp," the participating faculty varied widely in their evaluations of the usefulness of the training. Faculty at intermediate levels developed resistance to investing more time in a process that did not initially advance their capabilities or relate directly to their teaching. Their reaction revealed a need for assessment prior to developing a training design.

With these realizations, the partners and director began to redesign the operations of the project for the second year. StarTEC hit its stride in the 2001-02 project year. The partnership learned that success would require some common goals and activities for the sake of evaluation and measurement, but variable models would be necessary to address the diversity and complexity of the organizations and participants involved. A project structure of this kind would also require intensive management and coordination at the state and institutional level.

The activities conducted at each partner institution to achieve the objectives varied, resulting in a numerous models. Among the lessons learned from the experience of working with a variety of higher education institutions is that while the objectives and fundamental training concepts could be the same for all institutions, each required a certain amount of flexibility and customization within the project in response to:

j) the resources available at the institution and their K-12 districts,
k) the training needs of the faculty and preservice teachers,
l) the institutional culture that can affect the willingness of faculty to participate,
m) the scheduling of training and availability of on-line resources, and
n) the level of institutional commitment and support.

MEETING OBJECTIVES

StarTEC Objective 1: The technology education provided by the consortium teacher preparation programs will meet or exceed California's new *Program Quality and Effectiveness Standards* in the area of technology.

All six partners redesigned their program requirements, coursework and curriculum to meet or exceed California's Program Quality and Effectiveness Standards for technology. Some began to phase out discrete technology courses, replacing them with the integration of technology into teacher education courses, while others created new courses to provide a foundation for the skills expected of every student in the program. Their program redesigns were submitted to the state for approval. Each of the StarTEC partner institutions received program approval for meeting the California Technology Standard in their teacher preparation program.

The approved program documents included evidence of the integration of instructional technology into the teacher preparation coursework at each university according to the CCTC's Technology Standard. The primary evidence included a matrix of the coursework required for each teacher preparation program that includes the portion of the standard addressed in each course, and the supporting course syllabi that describe in more detail the use of technology by the preservice teachers to complete course requirements. For each program, the core classes require the use of technology. The plans were approved under state supervision through peer review.

From these program revisions, several models for adopting the standards emerged. The first among them stemmed from one of the StarTEC dissemination efforts which demonstrated how the California Technology Standard is aligned with the ISTE (International Society for Technology in Education) and CTAP (California Technology Assistance Project) standards. A matrix was created and reviewed by experts from each of the panels that created the ISTE, CTAP and CCTC standards (attachment). The results were compiled and published on the StarTEC web site. (http://www.startecproject.org)

Through this alignment of the standards, the StarTEC project at California State University, Bakersfield created a model for certifying levels of proficiency in education technology by assessing faculty and preservice teachers in instructional technology. Using the CTAP certifications Levels I, II and III, CSUB has developed a technology plan, which includes the provision that all faculty will attain CTAP Region 8 Levels I and II and that all credential candidates will attain Level I before or during the program to obtain a preliminary credential and Level II to qualify for a professional credential. (http://www.ctap.org.)

The CTAP certification process is used by all K-12 school districts in the Bakersfield region to guide professional development for classroom teachers, ensuring that new and veteran teachers accomplish the same level of technology competency. StarTEC was instrumental in providing training and incentives for 155 teachers, university faculty, and students certified to one of three levels by January 1, 2003. This model of partnership, based upon its level of participation, indicates the critical need for continuity of professional development between teacher preparation institutions and K-12 schools. Having K-12 schools and colleges of education share the same system for certifying technology proficiency resulted in unprecedented articulation of skill development. Candidates are presented with a coherent system of technology skill development from the beginning of teacher preparation through induction into the teaching profession. An added benefit was a marked increase in efficiency of delivering training to educators at all levels. Training targeted on specific proficiencies led to certification that ensures that the full skill set at that level was demonstrated.

The technology certification model developed by CSU, Bakersfield to align with the California Technology Standard and the ISTE and CTAP proficiency standards demonstrated early and significant results. Most CSUB COE faculty achieved a minimum competency of Level I in only twelve months. Smaller institutions focused on ensuring that all faculty receive this equivalent of training, and selected faculty have been supported to do advanced training as institutional technology leaders. University of California, Riverside (UCR) created a different model that also addresses the need for bridging between teacher education and K-12 schools.

UCR is a small teacher education program that adopted the cohort model. This model offers the opportunity for credential students to freely share information, to develop a professional network, and to pursue professional growth outside of the structured program. Therefore, their model for the integration of technology needed to respect their cohort groups. With this in mind, UCR decided upon workshop trios to implement the second year of the grant project. The trios consisted of one credential student, one faculty supervisor and one K-12 master teacher. Together each trio designed a unit integrating technology, using the Unit of Practice developed by the Apple Classrooms of Tomorrow (ACOT) project. The student teacher was then equipped with a teaching resource that was coordinated with both teacher preparation and K-12 learning. As the final stage of implementation, the trio taught a class using the integrated Unit of Practice. The trio model was highly successful and continues to be used in the program.

A third model was developed in another large state institution at California State University, Fresno, which houses state of the art technology resources. This COE faced other challenges because their large size meant a less cohesive faculty and student body. Their challenge was to create incentives strong enough to overcome the conflict of faculty time with research, teaching and governance. With the support of the dean of education, the faculty was offered professional advancement to implement the technology plan approved by the state. Because some faculty has already attained a high level of technology mastery prior to the project, they felt the initial training was not useful. So another incentive was offered in the form of advanced training. This model led to the concept of developing technology leaders to build sustainability for the continued development of technology usage after the completion of the grant project.

A fourth model emerged at a small private institution, University of San Francisco, that used technology to strengthen assessment in teacher preparation through electronic portfolios. As the institution prepared to meet the new teacher preparation standards, they realized that their greatest need as an education culture was for a formative assessment to validate the quality of their program. By preparing their faculty and candidates to produce the end product of electronic portfolios, they were able to create a unifying thread for their program that would also meet the technology standard since a relatively high level of technology skills are required for this product. This kind of wholistic model was facilitated by a fairly small culture that could reach consensus and share goals more easily that the large state institutions. Considering these models in the context that made them successful is critical to understanding the cultural components of that impact major change and reform in education.

The StarTEC project gave each partner a focus for the alignment of their instructional program with the CCTC Technology Standard. StarTEC created models, and the partners have become mentors for other teacher preparation programs who were implementing the California Technology Standard and applying for program approval.

The projects documented their integration models on videos, which have been streamed onto the StarTEC website (startecproject.org), and several of the StarTEC project coordinators have become technology consultants for the other institutions. This aspect of professional leadership, which was tested within each program at the participating institutions, became another effective model to disseminate technology competency on a larger scale.

StarTEC Objective 2: COE faculty (education, arts and sciences) will increase the use of technology modeled within the teacher preparation courses.

Each partner COE developed faculty requirements that incorporated the use of instructional technology tools into the professional activities of faculty, Supervising Teachers and Master Teachers. The professional integration of these tools served as a model for students who are identifying effective ways to use technology in the classroom. The technology products included portfolios, videos, and web pages. In addition anecdotal evidence and testimonials demonstrated that the level of faculty understanding, interest, and skills increased. All of the StarTEC partner institutions reported the use of technology in 100% of their teacher preparation courses.

It is important to note that institutional cultures changed as well along the way. When faculty were required to submit and receive their communications through technology, their motivation and frequency of use increased. At all institutions faculty are using technology for: communication; the development of professional portfolios; K-12 summer schools with technology rich curriculum; organizing planning teams of faculty, Supervising teachers and preservice teachers (Trio Institute); adopting and adapting curriculum planning software for teacher education (Copernicus, Apple Computer's Unit of Practice, Inspiration); the use of video for reflective coaching; and, distributing course outlines and assignments through web-based technology (Web-Course-in-A-Box and Blackboard). Several of the partners also increase their articulation with their Colleges of Arts and Sciences through cross-training and professional dialogue related to program requirements.

All of the programs now require teacher candidates to submit electronic portfolios as evidence of their content and skill mastery. The development of electronic portfolios by faculty members became the vehicle by which the faculty developed a personal knowledge of technology tools because of the relevance of the electronic portfolios to their classroom instruction. Faculty received the added benefit of converting their own professional portfolios electronically, a primary incentive. Because this kind of product requires pre-existing basic skills, it was necessary to introduce it in the second and third years of the project. By this time, all of the StarTEC participants were adopters, some were adapters, and a few were innovators (Evolution of Thought and Practice). The aspect of developing skill levels over time cannot be overemphasized, nor can the understanding that the pacing over time varies widely from one individual to the next. This aspect of the project was also reinforced by Apple's online instruction, "Just in Time," which allows users to advance on their own time schedule, at their own pace. Successful learning reinforced Vygotsky's learning theory regarding proximal zones for maximal learning as participants demonstrated a need to reach slightly beyond their present stage of knowledge but resisted requirements to go beyond without mastery.

After two years of training, faculty members who displayed an interest and enthusiasm for integrating instructional technology in the teacher education program received funding through StarTEC to become technology leaders within their department. The faculty leaders contribute to the sustainability of the improved teacher education programs as trainers. Faculty are replacing outside trainers in formal training sessions and providing critical follow-up technical assistance.

The Trio Institute was born out of frustration about the lack of articulation between supervising teachers, master teachers and preservice teachers. The three groups felt that they needed common planning time to establish uniform expectations and supporting activities to optimize the integration of technology into the student teaching experience. The model of the Trio Institutes that originated at the University of California, Riverside and was then adopted by several other partners is a two-day training at which each trio creates a Unit of Practice for the student teacher to implement.

There have been several generations of training evaluation tools in StarTEC. These include focus groups, online self-assessments, Training Evaluations and Training Observation Evaluations. A summary of the data is included as at the end of this report. A key lesson learned from the StarTEC training evaluations has been the development of training content and training schedules that met the immediate needs of the participants. Faculty members wanted to learn the software and hardware that would be immediately useful for them, such as presentation software (PowerPoint) and planning software (Inspiration). Formal workshops which all participants attended were less successful than mini-workshops that were leveled by ability (Apple's Evolution of Thought and Practice) and offered a larger variety of training topics. The democratic planning of StarTEC training workshops encouraged by Apple Computer also increased the support of the StarTEC goals and created synergy among the faculty.

StarTEC found that training needs to be flexibly scheduled, adaptable to faculty needs, and inclusive of integration models to attract the most participants over the period of the year. Training also needs to take place over time, probably several years, to create a cultural change and paradigm shift. The key sustainability strategy was the development and deployment of Peer Technology Leaders within each COE staff.

StarTEC Objective 3: COE faculty will demonstrate "Future Think" approaches and teacher technology knowledge in their teacher education coursework.

The StarTEC project set the goal of moving faculty to the innovation level on the Evolution of Thought and Practice scale (attachment). They were given extrinsic incentives in the form of stipends to take on the role of leadership in the integration of technology with their teaching institutions by modeling, instructing, and advocating for technology in teacher education. However, the strongest incentive seemed to come from the respect of peers and the reward of actively changing their departmental cultures.

Through the training sessions, faculty created their own web pages for their classes, developed online instruction, constructed their own professional portfolios, and utilized curriculum software resources to expand and extend their teaching capabilities. Each institution now has at least one technology leader among their StarTEC trained faculty, instructing and supporting fellow faculty who are at the adoption level. Participation in StarTEC has effectively changed the cultures at the teaching instiitutions involved, from peer mentoring to hiring criteria. Faculty are collaborating on instruction and mentoring one another in technology. Teacher candidates have been invited to engage with faculty as technology mentors in some cases, creating a role reversal that has heightened the sensitivity of faculty by mirroring through technology the steep learning curve of teacher education. Higher education administration has raised the level of the use of technology by requiring faculty to submit grades, receive communications, and develop professional portfolios online. However, this objective also was met in a way not anticipated by the authors of the grant proposal.

The StarTEC partnership with ACSA and Xerox allowed the author of the grant proposal to attend the Xerox Parc institute and develop an agreement to pilot a new server for Xerox (Sparrow) which is being used by the state to inform and review education reform in California, of which the new technology standard is a part. Sparrow is specifically an interactive web-based and group-editable shared document system that was created by scientists at PARC (attachment). Sparrow has been successful in the ongoing review of over 87 teacher preparation institutions and 150 induction programs across California to insure the quality of a massive reform of which technology integration is a part. The Commission on Teacher Credentialing is currently negotiating the purchase of Sparrow to use technology to facilitate all of its program reviews. This unexpected outcome has initiated a paradigm shift in the ways in which education organizations, agencies and institutions interact statewide, providing a vehicle for low cost, convenient dialogue and interchange. The adoption of the Sparrow system, with some adaptations, has broad implications for linkages in the education community, including collaborative research, curriculum planning, teacher support and peer review to name a few. Since it will be used by all California teacher preparation institutions through the CCTC, the catalytic range of its uses are unknown at this time.

StarTEC Objective 4: Preservice teacher candidates will demonstrate proficiency in the use of instructional technology in the classroom for achievement of the new instructional technology standards performance criteria.

All StarTEC partner institutions have redesigned their preservice teacher training and graduation requirements so that all candidates satisfy the state technology requirements for credentialing and the successful conclusion of teacher preparation coursework.
The teacher education programs have created requirements that preservice teachers will demonstrate their proficiency with technology integration. Now that the Commission on Teacher Credentialing has approved the program plan for each university, the faculty

have implemented the California standard into a programs that preservice teachers complete to receive their credentials.

Over half of the participants in StarTEC training are supervisors of preservice teachers. The training has provided them with the knowledge base upon which to effectively assess candidates' technology proficiency in the classroom. The Trio Institute planning models have also drawn the preservice teachers directly into StarTEC training. Supervising teachers have a more immediate need for training with instructional technology because they are responsible for evaluating preservice teachers during their field experiences and coaching them for improvement. It is critical to the success of preservice teachers that the teacher education program requirements are aligned with the state credentialing requirements and that their field supervisors can lead them to that point.

One new model developed by StarTEC for demonstrating candidate proficiency has been improved access to technology that can be checked out from the university for use in the K-12 classroom and then returned to the university with a product (video, electronic portfolio entry, examples of student work). This innovation resulted from the lack of technology available in many of the K-12 classrooms. The "loaner kits" began as mobile laptop computer labs provided by StarTEC funds to give faculty greater access to technology during the training sessions. With the completion of faculty training the "labs" have been used frequently to support technology-based instruction in locations where there was no technology presence previously, forging a new link between higher education and K-12 schools. Access to instructional technology has become a more critical issue as teacher preparation programs are requiring an increasing number and greater quality of demonstrations of proficiency with instructional technology by preservice teachers. Therefore, it has become necessary and valuable for the universities to share their technology resources to support ongoing applications of technology in K-12 classrooms.

Some concerns remain that students will receive a consistent level of technology skills to implement curriculum and facilitate the learning process through technology integration. Further study may need to be done to measure, for instance, the difference in effective technology usage among candidates who received only integrated technology, those who took only a skills-based discrete technology course, and those who experienced both methods in teacher preparation.

StarTEC Objective 5: Effective models for teacher preparation programs within California to meet the new *Program Quality and Effectiveness Standards* in the area of technology will be disseminated statewide.

One of the federal requirements for the grant project was to build a sustainable system of technology integration into teacher preparation. The sustainability of the goals and activities of the StarTEC project is supported by two activities, i.e. Peer Technology Leaders and Peer Assistance Program. The key sustainability activity is the development of Peer Technology Leaders at each site. StarTEC training participants who have developed the skills and interest to help others have been given a stipend to serve as mentors for other faculty members. These Peer Technology Leaders will continue to serve as department resources after the StarTEC funding period ends.

StarTEC partners are now using their knowledge of technology integration to advise other teacher educators statewide in a "lessons learned" format. Through formal workshops, an information web site (startecproject.org) and informal consulting, StarTEC partners are assisting others in making sound decisions about the use of technology in education based upon the experiences and research data provided in this report. StarTEC also identified education institutions that had not met the state technology standard, provided a free technical assistance day-long workshop, and offered continuing consultative support to attendees. The leadership that PT3 built in StarTEC partners created a sustainable effort that reaches beyond each institution across the state. StarTEC partners are recognized across the state and the nation as innovators, facilitators and consultants in technology integration. Several StarTEC project coordinators served as reviewers for the approval of institutional technology plans. For plans which did not meet the state standard, reviewers were advisors for plan improvement toward approval. The experiences of the StarTEC Project made these reviewers uniquely qualified to be state-wide leaders in education technology.

The following table indicates the StarTEC dissemination activities for 2001-2002.

Dissemination Activity	Dissemination Audience
Computer Using Educators (CUE) Pre-conference Workshop Fall 2001 Sacramento National Educational Computing Conference, Summer 2001 Chicago	a) Teacher preparation program faculty b) K-12 Staff Development program developers c) Educators interested in connecting the National Educational Technology Standards (NETS) with California Standards d) USDE PT3 staff e) Project personnel from other PT3 projects
Annual PT3 Conference 2001 d) Street Fair e) Statewide Program Standards f) Video Case Study Presentations	f) Teacher preparation program staff interested in PT3 grants g) USDE PT3 staff h) State Educational Agency (SEA) Staff i) Project personnel from other PT3 projects
StarTEC Website Development and Publicity o) Video training models p) Case Studies q) Resources r) Success stories s) Lessons Learned	j) Project personnel from other PT3 projects k) Teacher preparation program staff interested in PT3 grants l) K-12 PT3 partners m) USDE PT3 staff n) State Educational Agency (SEA) Staff

	o) Educational technology specialists, K-12 classroom teachers, and regional technology consortia p) Linkage to PT3 web site for national education community
StarTEC Matrix of California Technology Standard and ISTE Technology Proficiency Standards distributed	q) Teacher preparation program staff interested in PT3 grants r) K-12 PT3 partners s) USDE PT3 staff t) State Educational Agency (SEA) Staff Educational technology specialists, K-12 classroom teachers, and regional technology consortia u) Project personnel from other PT3 projects
Technology Implementation Workshops	a) Teacher preparation program faculty at California State University at San Marcos
Computer Using Educators Spring 2002 Anaheim	a) Technical assistance workshop for developing compliance plans to meet the State's new technology standard. b) Continuing consulting to meet technology standard.
Sparrow: Successful Pilot of Technology Platform for institutional program review by the state accrediting body	c) State of California colleges, universities, K-12 schools and county offices of education
California Council of Teacher Educators (CCTE) Spring 2002 Research Session	d) "Research and Best Practices" session on grant activities, models and findings. e) Participation in the Technology SIG.

The diversity of integration models developed under StarTEC makes it difficult for a central disseminator to convey their richness. In its work with teacher educators StarTEC learned that an effective integration program must be flexible and meet individual needs. To that end, the models that StarTEC developed address a variety of institutional types, cultures, resources, and capabilities. In using Apple's Evolution of Thought and Practice, the project revealed that the learning curve in technology varies dependent upon many factors. The use of a needs analysis component is critical to any effective design. StarTEC tried a number of types of assessments but did not find any that completely suited the needs of higher education faculty. More time would be needed to create one that reveals the educator's aptitude, interest, needs for technology.

Each StarTEC institution documented the work of the project at their site including such factors as: type of credential program, cultural issues, leadership and administration considerations, essential conditions such as facilities, access and materials, support needs, training plans. A video was produced from each site that documents how each institution uniquely molded its teacher education program through StarTEC to seamlessly infuse the technology standard. Other institutions will be able to use the models presented on the web site to develop their own integration programs.

INSTITUTIONAL CASE STUDIES

University of California, Riverside: Collaboration through technology

WHAT IS A TRIO WORKSHOP?

Because teacher credential candidates are now required to demonstrate their ability to integrate technology into their teaching in their own classes with K-12 students, supervision now involves helping student teachers/interns find ways to demonstrate these abilities in their placements. We recognize how important it is for credential candidates to plan these activities with their cooperating teachers, according to the teachers' goals for the class. We also recognize that technology resources vary within and across schools, and that cooperating teachers have different levels of technology expertise.

GOALS OF A TRIO WORKSHOP

- To bring current collaborating groups together (supervisor-student teacher-cooperating teacher, or supervisor-intern teacher). Each supervisor identified one student teacher or intern from his or her cohort and that student's current cooperating that participated with him or her in the workshop. (note: interns did not have cooperating teachers but met with their supervisors during the workshop as a "duo").
- To show all participants how to take an existing unit and incorporate technology into it that will enhance learning of substantive content, concepts, and technology skills.
- To use the Unit of Practice model that emerged from the findings of the Apple Classrooms of Tomorrow (ACOT) research as a framework for technology integration.
- To develop procedures and recommendations for credential candidates, cooperating teachers, university supervisors, and principals that will help credential candidates demonstrate their technology competencies in their class placements. Prior to the workshop student teachers decided with their supervisors and cooperating teacher which curriculum unit or lesson would be worked on in the workshop.

COHORT DESCRIPTIONS

In Year 1 of StarTEC we trained 11 supervisors of teacher education and 2 faculty members involved with technology training in the credential program. This is Cohort 1. In Year 2 of StarTEC we included 3 new supervisors (in Cohort 2) who were hired for the new academic year. Their training in Year 2 was with Cohort 1, who assisted them in getting to a similar point in their understanding of the Unit of Practice and the way technology was to be part of the supervisor's work with student teachers and interns. The majority of cohort 2 consisted of ladder faculty members who teach foundation courses to credential students. Most training provided in Year 2 was targeted for either supervisors or faculty, who had somewhat different needs, although all sessions were open to and attended by people from both cohorts.

COHORT 1: SUPERVISORS OF TEACHER EDUCATION

Foundation for Change Developed in StarTEC Year 1 We ended the first year of StarTEC with a new plan for training preservice teachers to meet the California Commission on Teacher Credentialing standards in instructional technology. In the prior year (1998-1999), the technology course had been redesigned to address the newly adopted California CTC standards. The year-long course could be taken only in conjunction with the year of student teaching or interning. Year 1 (1999-2000) of StarTEC training focused on the Unit of Practice model and culminated in a session with all supervisors and technology faculty present to revise technology instruction in the UCR credential program. Consistent with the UOP model, it was our plan to truly integrate technology into supervision and instruction and reduce the training that would occur in insolation, i.e., avoid the oxymoron of teaching technology integration in a separate course. In that June session we examined every standard and determined whether it could be met in the context of the supervising seminar or individual superivising, or whether it would be necessary to address the standard in the "technology course."

Distributed Responsibility for Technology Training We thus began StarTEC Year 2 (2000-2001) with a supervising team that had been well trained in the Unit of Practice model and that had been part of the redesign of the technology component of the credential program. The participation in the program design contributed to the buy-in of the supervisors, in spite of the fact that they were now responsible for a much larger portion of the technology training. Training supervisors had received in Year 1 StarTEC had provided them with the tools and confidence to assume more of the responsibility for this training.

EVIDENCE OF CHANGE IN SUPERVISION PRACTICES

Seminar requirements Each supervisor is responsible for about 15 student teachers or interns for the entire academic year. Supervisors observe and meet with student teachers and interns weekly in their classroom placements and the cohorts also meet weekly for a seminar on campus. It is in these seminars that supervisors address all competencies to be met in University courses or in their teaching placements. Comparing syllabi for these supervising seminars during Year 2 StarTEC reflects the changes in technology instruction from Year 1. Supervisors required their credential students to demonstrate technology skills in their preparation of class assignments, presentations, and student teaching placements; requirements that were not found in the syllabi in the previous year.

Web-based communication All supervisors established web pages for communicating with their students in Year 2, in contrast to none of them having web pages the previous year. They posted course material that had been developed during StarTEC workshops and made available to all supervisors who wished to use them. Web-Course-in-A-Box, which is supported by Campus Computing and Communications staff, was selected for StarTEC training. Training was provided by our StarTEC trainer, Jim Beeler, in conjunction with Leo Schoest from the UCR Campus. The advantage of this teaching model was that Leo and his staff were available for ongoing support after the workshops.

Changes in technology course The technology course shifted from an emphasis on meeting the CTC standards for technology to a setting where students could develop basic skills if they needed them and advanced skills, such as video editing for electronic portfolios for those who were ready. Also, as part of this course, all credential students were required to write a Unit of Practice that was based on curriculum unit they had written for a curriculum development course and incorporated technology into the instruction. The changes in this technology course were possible only because of the StarTEC training of Cohort 1 in Years 1 and 2. The three new supervisors that were hired in Year 2 were quickly socialized into the importance of StarTEC and of full participation in technology training of credential candidates.

Evidence of student teacher skills demonstrated in other courses Student teachers are developing skills in their supervising seminars and technology course that are being seen by faculty in courses that do not specifically have technology integration as a goal of the course. An example is in the subject matter curriculum theory English course. A professor, who has been teaching this course for over 30 years, got the idea for a literary technology project from a StarTEC workshop in March, 2001. The remarkable student performance was attributed fully to StarTEC training of the supervisors, the revised emphasis of the technology course, and the effects of this training on their students:

Advantages of Democratic Planning of Startec Workshops Support for StarTEC training is also attributed to the synergy and joint planning that was encouraged by Jim Beeler, our trainer from Apple Professional Development. Instead of following a set curriculum for training, the supervisors participated in the planning of the workshops. They decided what they needed, what the priorities were, and what the order of training should be. The Trio Institute that was held April 24-25 was an excellent example of this. The idea of matching each supervisor with one student teacher and the student teacher's cooperating teacher in a 2-day workshop grew out of the Year 1 training. Each time we met for training on a particular topic, time was set aside to continue the planning of the workshop. The specific dates, agenda, and selection process were determined by the supervisors.

Trio Institute: Bringing All Parties to the Table (or computer) The Trio Institute was an overwhelming success. Comments from student teachers such as this were common: "I could never have learned this much or created a unit like this if I had not had help from my supervisor and my cooperating teacher." Student teachers are in a weak position when they let cooperating teachers know that they will have to demonstrate instructional technology in their classrooms in order to meet competencies. The Trio Institute helped identify ways that student teachers can accomplish this more easily and gain support from cooperating teachers. One of the barriers for student teachers and cooperating teachers is the lack of technology resources in many schools or classrooms. The Trio Institute identified these barriers and provided an opportunity to brainstorm for ideas to solve resource challenges. The school district Instructional Technology Director and three principals were present to provide perspectives and ideas from the school administrations.

COHORT 2: FOUNDATIONS COURSE FACULTY

Including the foundations faculty as a second cohort in Year 2, StarTEC brought new challenges, new designs, and some success. Some of the challenges were:

- Several faculty who had been teaching courses for many years were not inclined to think instruction would be enriched by integrating technology.
- Faculty were uncomfortable with the possibility of technology failures or of demonstrating a lack of expertise in front of classes.
- Faculty found it difficult to take time for training amidst other time demands. They have surprisingly little control over their schedules. Faculty from different specialization areas attend different conferences during the yea; every professional conference is likely to affect a subgroup of faculty when a training session is scheduled. Committee meetings must also take precedence over personal development. Many faculty members had to cancel their plans to attend a training workshop when committee meetings were set that conflicted with StarTEC.
- All faculty in the Graduate School of Education teach courses at night. Those who arrive home at 10 p.m. are unlikely to be motivated to attend a training session the following morning. As many faculty live 30-60 minutes from campus, travel time also figures into the length of the day.
- Faculty must reserve full days away from campus in order to conduct research and write manuscripts for publication. It is very difficult to "protect" these days, and easy to be tempted by opportunities for training. As much as faculty would like to interrupt writing days with technology workshops, doing this is dangerous to their productivity (and longevity) as research faculty. StarTEC is only one example of the temptations to use a writing day for something else. Most successful faculty have adopted a "just say no" response. As faculty plan these writing days according to their teaching schedules, it is rare to find a day that all can be free.
- Newer faculty (assistant professors) who grew up with technology and had less to learn, and senior faculty (who had fewer worries about publishing) were those that responded to invitations to StarTEC participation.
- Faculty want to know how to use specific software programs. They assume they will know how to integrate it into their teaching. They do not want to be taught the Unit

of Practice model or to know about the different stages of development in technology use. These concepts had to be introduced in the context of the software "how-to's."

- Like district teachers and supervisors, the majority of faculty do want to gain expertise with technology, even if not specifically for the purpose of enhancing their teaching. However, unlike district teachers who can be freed from teaching if a substitute teacher can be provided, or supervisors who can rearrange their visits to school sites to free up a day or two, faculty members cannot do either of these. Their schedules are sporadic and controlled by different groups. This was a big lesson–we had to find ways to work within these constraints.

Decisions Made Based on Lessons Learned: The Training that Did Occur The faculty who came to the first session came to as many sessions as their schedules would allow. The faculty, like the supervisors, appreciated being able to plan their own training topics and to schedule them during times of immediate use. For example, Web-Course-In-A-Box training was scheduled for the first week in January, when faculty would have their courses for Winter quarter planned but would still have time to make changes that incorporated technology. The timing was perfect. Faculty brought their syllabi, assignments (usually based on what they had done in the past), and lectures to the workshop and were able to revise their "unit of practice" which was their course for the quarter. Supervisors came to this workshop if they had questions about what they had done in the Fall. In March the workshop for faculty (and supervisors who wished to come) was held three weeks before the American Education Research Association and Council for Exceptional Children meetings. The focus was on Powerpoint and presentations. This gave faculty the option of working on an AERA or CEC presentation or working on class presentations. The timing of this workshop drew faculty that might not have come to simply learn more about presentations and Powerpoint.

Summer School Plans The summer school to be held at UCR this year was anticipated with great enthusiasm by UCR faculty and district teachers and planners. Two classes were held during July. The first class was incoming 9th graders who were taking a transition class (students expected to benefit from a course facilitating the move from middle school to high school). The second class was middle school students at-risk of school failure. They had average or above average intelligence but had emotional or behavior problems that made it difficult for them to learn alongside their peers. These students had been developing technology skills that meet or exceed those of their nonhandicapped peers. The premise of including this group of students in the summer school was that technology appears to be a vehicle for success. The focus of both classes was on video technology as a form of literacy. Students researched and wrote on a topic in preparation for an electronic video project. They used camcorders, digital cameras, and iMovie software to create their videos. District teachers were introduced to iMovie at the June workshop–they were novices that develop their skills along with the students.

Preparation for Summer School: iMovie workshop The final Year 2 training session was held the week before summer school and attended by supervisors (Cohort 1), faculty

(Cohort 2), and district teachers who would be co-teaching the summer school classes. This training was on video technology as a form of literacy and iMovie software, specifically. With this training fresh in their minds, we expected supervisors and faculty to be frequent visitors/participants in the summer school classes. It gave them opportunities to further develop their skills as they worked with the secondary students, and showed them new applications of the skills they had been shown in the workshop.

Administrative Reflections: The work that was accomplished this year would not have been possible without a staff member being assigned "StarTEC" coordination as part of her job duties. Coordinating all of the logistics of the workshops, hardware and software preparation, dissemination of workshop products to participants, and summer school arrangements could not have been done by the faculty member. This was a lesson learned in Year 1. StarTEC consumed far more time than a faculty member could devote if it was to be done as completely and effectively as possible. We worked as a team, and it took a great deal of time to attend all planning meetings, workshops, and oversee details. Nevertheless, all of the site coordinating funds ($8,000) were used to pay the portion of the salary of the staff member that was dedicated to StarTEC responsibilities. She attended the summer school each day to see that all logistics were accounted for. In addition, the programmer analyst in the Graduate School of Education devoted a great deal of time on hardware and software preparation and follow-up, as an in-kind contribution to the project. Were it not for this cohesive team, Year 2 StarTEC would not have been successful.

Lessons Learned Involving teacher education faculty-supervisors in all aspects of program restructuring as a StarTEC activity (part of workshop agendas). One workshop was dedicated fully to discussions of restructuring, other workshops had hours designated for this):

OUTCOME 1: Led to total commitment of supervisors to their new responsibilities for technology training of credential candidates

OUTCOME 2: Allowed for gradual change in reassignment of responsibilities to supervisors that was paced along with supervisor's developing skills

OUTCOME 3: Reality-based planning with those closest to credential candidates and their classroom placements

StarTEC at UCR took advantage of three characteristics of UCR's credential program that are unique among StarTEC partners:

1. Student teachers and interns stay with one supervisor for the entire credential program. Advantages of this characteristic to StarTEC and restructuring are:
   a. Training and demonstration of technology competencies can be aligned with candidates' developing skills and increasing teaching responsibilities in their classroom placements.
   b. StarTEC workshops could follow progress and challenges of each year's cohort of students through supervisor reports

2. Supervisors who observe candidates in their teaching placements are those who teach methods courses and seminars to their cohorts of student teachers and interns. Advantage of this characteristic to StarTEC and restructuring are:
   a. Supervisors can model technology integration in courses that are directly relevant to the candidates' training.
   b. StarTEC trained supervisors to integrate technology into their own courses
3. Several student teachers are clustered in schools. The supervisor spends blocks of time at the school and can teach methods seminars to student teachers at the school site. In schools involved in the Comprehensive Teacher Education Institute (CTEI), mentor teachers are also part of the professional development management team. Advantage of this characteristic to StarTEC and restructuring are:
   a. Supervisors can hold seminars on the public school campus in the environments where they are asked to demonstrate technologies.
   b. Increased communication between mentor or cooperating teachers lessens the burden of student teachers to meet demands of two trainers.
   c. StarTEC included K-12 teachers in several workshops on integrating technology into teaching units.

One trainer led all workshops over the 3-year period. In retrospect, this feature was a benefit because it:

- Gave continuity and allowed flexibility of training content.
- Made reflection and evaluation a routine part of the program restructuring process.
- Allowed trainer to get to know the skills and specific teaching responsibilities of each participant and to use this knowledge to individualize training for each participant.
- Gave the trainer an in-depth understanding of the credential program structure, goals, and local support and barriers to restructuring.
- Provided the trainer with opportunities to collaborate with central campus and School of Education instructional technology support staff
- Supervisors know local and campus-wide support staff. Staff is familiar with their needs.
- Made the trainer more of a facilitator of change than a skill builder—though skill development was definitely a by-product of workshop participation.

The involvement of K-12 teachers in workshops and summer school forged new or stronger bonds within the education community.

1. StarTEC was instrumental in helping to build new bridges with the partner school district that will make it easier for student teachers and interns to demonstrate competencies in the new standard. The participation of cooperating/mentor teachers in StarTEC workshops:

a) helped them see what technology competencies student teachers were required to demonstrate in their classrooms.
b) showed supervisors examples of technology-rich lessons and technology integration

c) highlighted competing demands for student teachers' time in their classroom placements

2. A StarTEC "Trio Workshop" was an opportunity for a student teacher's cooperating teacher and supervisor to work as a team by helping the student teacher develop a technology-rich unit, appropriate for the current placement
3. A StarTEC summer school co-taught by k-12 teachers who had participated in StarTEC workshops and University StarTEC participants resulted in a team approach to applying technology integration principles with middle school and high school students. The summer school was a "living laboratory" where the learning from workshops could be applied with curricular goals new to both groups
4. Collaboration on a school district technology plan that would benefit local schools and provide exemplary placements for student teachers and interns led to district appreciation of the need to provide resources and pedagogical and technical support to help student teachers and interns demonstrate technology competencies.

California State University, Fresno: Changing Culture

<u>Goals</u> The preparation of teachers requires a joint effort among many individuals who have a wide range of expertise in technology and differing needs and interests. The major goals of the StarTEC grant at California State University, Fresno are to:

- Involve education faculty, faculty from the content areas, and university supervisors.
- Provide professional development that is timely, appropriate, and responsive to individual needs and interests.

During year three, participants were able to choose from a variety of workshops provided by StarTEC, including basic technology integration, web design, Blackboard and multimedia. Workshops were scheduled based on the expressed needs of faculty and supervisors. Online courses provided additional opportunities for participants to engage in professional development when and where it was most convenient for them.

The literature on professional development strongly suggests that follow-up coaching is a critical component of an effective program. Therefore, this year StarTEC is providing stipends to faculty who serve as coaches and mentors assisting other faculty to incorporate additional technology into their courses and supervisors who want to provide a richer technology experience for the student teachers they supervise. During Year 1 of Startec, we had some difficulty in bringing faculty to the training for various reasons: 1) it was not possible to plan a cogent schedule with the partner training organizations, 2) funds were not readily available to pay stipends to faculty, and 3) there was a lapse between notification and implementation of the grant. Planning was difficult, at best. As a result The School of Education and Human Development ended up with few faculty participating in the first year of training. Although over 25 faculty members participated in the boot camp, only a few of those attending continued the training in Year 1.

In Year 2 of the Startec project we trained 34 faculty members and 4 supervisors of teacher education involved in the credential program. The training provided in Year 2 was targeted to both groups in the teacher preparation program. A matrix exhibits the names of the faculty and the number of hours is attached for detailed information. Fourteen faculty participated in less than 10 hours of training while 16 others took between 18 and 54 hours of training. There was a significant gain of participants after Associate Dean Berta Gonzalez encouraged faculty to participate in the training.

Training Offered: Apple Computer offered training on the Unit of Practice and on multimedia applications. Participating faculty were generally very satisfied with the training provided by Apple. Only one participating supervisor and one faculty member felt that the training needed improvement. There was an expectation for more advanced multimedia training in Year 3 of the grant to include iMovie.

We selected Teacher Universe to provide training on web design exclusively. Participating faculty felt that the training was excellent and wanted more advanced training in Year 3 of the grant.

Responsibility for Technology Training: The School of Education and Human Development submitted a Technology Plan to the California Commission on Teacher Credentialing to conform to Standard 20.5 to begin to apply in year 2002. This plan calls for technology infusion in the teacher preparation program in all three programs: Multiple Subject, Single Subject and Special Education. The Startec grant has played a major role in preparing faculty in these programs for technology infusion. A specialized course will be offered for the advanced credential candidates. Participating faculty in the Startec grant redesigned the course to satisfy the new technology standard.

Evidence of technology infusion: Faculty who never used technology in the teaching-learning process have began to use technology in their instructional practice. Some of these faculty new to technology are designing web based instructional materials for their courses. Faculty who had technology experience have enhanced the application of technology and require student active application of technology in their class work and home assignments. Computer lab utilization has increased since the inception of the Startec grant. The computer labs are currently being used to teach methods courses otherwise taught in regular classrooms without technology. Faculty reserve the computer classrooms for Internet navigation and searches, for the development of presentations and for the design of multimedia projects. At least one faculty member has changed his instructional practice to include the Unit of Practice model. As a semester theme students are required to design multimedia applications in the context of the Unit of Practice for a K-12 target group.

Partner School: In Year 1 we had three sessions with Parlier Unified School District teachers and a total of 45 children attending summer school at The School of Education and Human Development. Teachers from PUSD conducted classes in one of the computer labs at the School of Education. They worked in close collaboration with two Education faculty. Students prepared multimedia presentations in the areas of Social Studies, English and Mathematics.

For Year 2, a total of 90 students have registered to participate in the summer program at California State University, Fresno. The grant Director conducted three continuous days of training for the PUSD teachers who will lead the summer project. The school district purchased 20 copies of the Secondary Multimedia Kit from Apple. The teacher training was based on the multimedia kit, which will also be used by Parlier Unified School district children.

Overcoming Challenges: A continuing challenge to achieving our goals has been enlisting faculty participation. One major obstacle to faculty involvement has been committing to the forty hours of professional development required by the grant, given the demands already placed on faculty time. The stipends provided by StarTEC were an important incentive, but sometimes the additional money did not offset the problem of finding time in a busy schedule. Another obstacle was finding a commonly convenient time to schedule workshops. Faculty teach at different times and many also supervise. What was most convenient for education faculty was not always convenient for faculty in subject matter areas. We have found administrative support and encouragement are invaluable in helping address these challenges.

Increased participation in StarTEC has resulted in another challenge, that of greater demand placed on technological resources. As more faculty incorporate technology into their classes, there is a need for more resources to support their efforts.

Rewards of Participation: We have been pleased with the involvement of faculty both from the school of education and from the content areas. So far this year, fourteen content-area faculty have attended StarTEC workshops. The involvement of content-area faculty is an expansion of our efforts. Many of these participants are building on skills and knowledge they received at a technology institute sponsored by another PT3 grant on campus. StarTEC has been able to provide faculty with continuing support as they worked to implement some of the ideas about technology integration gained from the institute.

We have also been rewarded by the involvement of university supervisors. At this time, six fulltime supervisors a support staff person and one master teacher are participating. We feel it is one of our continuing responsibilities to provide supervisors with technology expertise that will be of valuable to them in their professional roles.

Faculty involved in the grant continue to be generous about helping one another. This culture of collaboration is critical to the sustainability of the efforts supported by StarTEC. The grant has been able to provide financial support to those who are willing to serve in this important role. We are encouraging content-area faculty to serve as mentors to another individual in their department or school. We also have faculty from the school of education interested in mentoring over the summer.

We have seen additional course syllabus changes that reflect increased knowledge and skills in technology. These include the use of the Internet for collaborative activities among students and the use of web-enhanced courses. The acquisition of a mobile lab enabled faculty who would otherwise not have access to a lab to integrate technology in ways that actively engage the students in using the computer and model strategies for integrating technology and for managing technology-rich classrooms.

This summer the Kremen School of Education and Human Development will continue to provide a technology integration lab model in partnership with Parlier Unified School District. Three 3-week sessions will be offered to Parlier High School. Twenty-five to thirty students will take part in learning activities led by Parlier Unified High School teachers. Each session will have one high school teacher and a collaborating School of Education faculty member. Past summer experiences have been very successful. Teachers who participated in the last two years summer program have become technology integration models for their school. The high school students who attended summer sessions have also taken leadership roles at their school site.

California State University, Bakersfield: Education Technology Certification System

The California Technology Assistance Program (CTAP), a consortium of regional offices coordinated by the California Office of Education which developed its own technology standards for teachers. Region 8, consisting of four central California counties, decided to build on the work of the CEAP by taking the technology standard's factors to consider and using them as skill sets for technology proficiencies. The CTAP Region 8 Advisory Committee met several times and developed a rubric for assessing technology skills (http://www.ctap.org/ctc/). The rubric has been used by K-12 districts to organize professional development activities and by teacher preparation programs at CSU Bakersfield. Project TNT included a task force on Technology Proficiencies and helped coordinate the effort. StarTEC partnered with CSU Bakersfield in 2001 and provided equipment, training and stipends to ensure the participation of CSUB instructors. The StarTEC resources proved vital in getting a critical mass of instructors certified, beginning a change in the culture of CSUB and local schools in the way they viewed and implemented instructional technology.

The CTC technology standard divided its levels of proficiency to articulate with the system for obtaining a teacher credential in California, which is a two level system. Meeting Level 1 is a requirement before a candidate can be recommended for a preliminary credential. Meeting Level 2 is required for recommendation for a professional clear credential. Level 1 is primarily personal computer skills with some application to teaching responsibilities; Level 2 involves the integration of computer skills into teaching responsibilities.

CTAP Region 8 proficiencies have been organized into a rubric based on the two tiers described above and added a third level for advanced certification. All certification is done on the basis of portfolios assembled by the teachers. Teachers can be certified at Level 3 as either mentors, whose main responsibility is training other teachers, or leaders, who serve as tech coordinators or administrators. Level 3 teachers can certify Level 1 and 2 teachers.

Results

As a result of implementing a coherent approach to certifying teachers at various proficiency levels, a number of positive results have occurred.

First, technology skill training is directed toward meeting the levels of certification. This ensures that teachers attending training sessions are at an appropriate skill level and for specified skill development; avoiding some teachers being lost and others bored. This also allows all training at K-12 schools and university teacher credential programs to be articulated on the factors underlying the technology standard.

Second, teachers are encouraged to attain certification at all levels. Some schools offer a bonus for attaining Level 2. Level 3 teachers often receive stipends for the training and administrative tasks they perform.

Third, by having Level 3 teachers certify Levels 1 and 2, the presence of expertise has been greatly expanded. Most local schools have at least one Level 3 teacher and many schools are including the attainment of specified percentages of faculty reaching each level by specified deadlines. A strong cadre of Level 3 teachers is being developed and will soon be adequate to provide technical support for local schools.

Fourth, by having a common certification system, unprecedented collaboration is occurring among schools and university teacher credential programs. Level 3 teachers are participating in the writing and implementation of a variety of grants and projects involving technology. CTAP Region 8, local teachers and university professors have collaborated in developing a web site that includes the technology proficiencies rubric, application for certification, and sample exhibits that meet most proficiencies. In addition, a list of certified teachers is maintained at the CTAP Region 8 office and is posted on its web site. This is a further incentive for teachers to attain certification as it indicates that all teachers are expected to have demonstrated technology skills.

Articulation between CTAP Region 8 and instructors in the university teacher credential programs has been difficult. University professors have been slow to get certified to Level 3. CTAP Region 8 has offered to provide such professors with Level 3 teachers so students in university classes can have their portfolios certified officially.

Conclusion

The implementation of a technology proficiency skill sets certification system based on a state technology standard has had dramatic positive effects on the development of technology skills in local schools. StarTEC provided the resources to ensure that training, incentives and equipment were present. The certification of hundreds of teachers at Levels 1 and 2 has encouraged many teachers, including those with life credentials, to develop technology skills that enhance the teaching-learning process. The increasing presence of Level 3 teachers is providing that most commonly missing element in technology professional development: adequate and accessible technical support. As an added benefit, the awareness of the importance of technology in schools among Level 3 teachers has produced that second most commonly missing element: equipment and training as a result of grant writing activities.

StarTEC arrived at a watershed moment and has had a profound effect on the technological component of the teacher preparation program at CSUB. As the new technology standard goes into effect on July 1, 2002, the system described in this paper can be expected to continue to promote the development of technology fluent teachers in local schools. The future will see a transformation of regional school culture as a result of the infusion of technology into the teaching-learning process at all levels. Teachers will be better equipped to address and assess the many content standards.

Students will increasingly work on real world problems collaboratively and produce professional quality projects. It is hoped that digital divide issues will be solved by providing poor districts with adequate technological resources.

University of San Francisco: Using Technology as an Assessment Tool

The University of San Francisco (USF) prepares teachers in seven regions and local programs in California, China, Mexico, Hungary and in specialized teaching environments such as the program at Yosemite and Marin Headlands Institute. USF joined the StarTEC cohort in its last year and collaborated with UC Riverside in researching the use of electronic portfolios to document teacher development over time. The USF faculty were asked to set one year goals for their personal growth in using technology. On-site faculty and graduate student mentors provided individualized instruction in these goals. Group workshops were held to address programmatic issues during which the faculty determined that they each wanted to create their own electronic portfolios.

Concurrent with the StarTEC efforts, USF volunteered to be an early adopter of California's new teacher preparation standards along with the new technology standards. As a result, USF was challenged to completely redesign their teacher education program for all campuses to align with the new program standards which include integrated technology, the Teaching Performance Expectations (TPE) and the new Teaching Performance Assessment (TPA). (http:/www.ctc.ca.gov) During the school year 2001-02, this institution underwent a self-study experience resulting in full re-accreditation with commendation.

Through the self-study, the university chose electronic portfolios as the means to document student performance correlated to the TPEs and the technology standards. Leadership for this responsibility was divided among all full-time faculty who worked with all adjuncts and regional campuses with regard to two or three teacher preparation courses. These teams determined at least one assignment from each course to demonstrate both the TPE and technology standards that would be taught in all sections of the course on all campuses. This core assignment became the artifact from that course submitted to the teaching portfolio.

Four technology benchmarks for credential candidates were created:

d) A technology "boot camp" to be held prior to the beginning of the semester in which a candidate enters the program during which basic technology skills required to be a student in the program and access to technology resources are established.

e) First semester: two unit anchor course which covers pedagogy, classroom management , lesson planning and standards integrating technology. The structure for the working electronic portfolio is established in this class.

f) Second semester: candidate portfolios are reviewed during the student teaching semester. At this time candidates are advised as to their progress and missing elements.

g) Third semester: one unit course allows candidates to complete their working portfolio during their final student teaching performance. Samples of student work, lesson plans, and observations of their teaching are included. Students extract from this portfolio to create their final "exit" or marketing portfolio.

Across this continuum, the new TPA can be added to the electronic portfolio along with student teaching observations, master teacher comments, and faculty feedback. The closed system that USF has adopted allows candidates to select when their artifacts can be reviewed and who has access to them. At the end of the process, students are able to download their whole portfolio to an alternate storage device such as a recordable CD. The StarTEC funding provided the means to support faculty in developing the skills necessary to implement this highly integrated technology endeavor. The CCTC provided the motivation to change and adopt the technology tools.

DATA SUMMARY

StarTEC can contribute to the field of technology integration through an increased understanding of the complexities of higher education reform related to technology integration and the key elements to effective technology training plans. The anecdotal data collected on the training programs through evaluation surveys revealed the following outcomes:

1) The integration of technology into teacher preparation increased the level of collaboration between faculty, students, supervisors, and master teachers.

2) Faculty developed empathy for the learning process through adopting technology and increased their confidence as instructors.

3) Teacher candidates increased their interaction in the learning process by sharing their work and resources through technology.

4) The use of interactive video brought better focus to the coaching/supervision process.

5) Technology extends classroom time through threaded discussions.

6) Instructors reported higher quality student work submitted electronically.

7) Faculty and candidates became more critical users of online resources.

8) Candidates expanded their teaching resources through use of the Internet.

9) Communication increased in the learning process through email and web pages.

10) A self-paced, flexible format of the training respected adult learners.

11) Immediate opportunity to apply new learning is critical to retention of the knowledge. This can pose a problem when technology resources are unavailable or limited. Technology will be used most effectively when it becomes as invisible and available as pencils in the classroom.

12) Access to a variety of appropriate software increases the motivation that moves learners forward from adoption to adaptation and innovation.

13) Face to face training is critical for adopters. New technology users are reticent to use online training until they move into the adaptation phase. Even then they rely heavily on technical assistance.

14) Integrating technology requires faculty to re-think their curriculum and how they teach it.

The following table shows the number of hours that different types of training were attended in the StarTEC project:

Year	Training Category	# Trainings	# of Attendees	Total Hours Attended
2000/2001	Curriculum	10	245	1584
	Software	13	108	918
	Other	9	196	1357
	Unknown	2	29	140
	Totals	**34**	**578**	**3999**
2001/2002	Curriculum	24	376	2912
	Software	14	263	1759
	Other	3	49	179
	Unknown	10	197	1042
	CTAP Workshop	16	67	268
	Totals	**67**	**67**	**6160**

*Other includes "Training Planning", "Hardware", and other miscellaneous trainings. USF and CSU, Chico hours are not included in these totals.

Based on participation, curriculum and software were the most useful kinds of technology training. The curriculum sessions most often focused on creating technology integrated lesson plans and technology-based teaching materials and resources. Software sessions included instruction in such products as Inspiration, Blackboard, WebCT, Final Cut Pro and iMovie.

Final Analysis

The StarTEC project was originally designed to accommodate such factors as time, cost, logistics, and federal grant guidelines. The design assumed that all participants, regardless of level of knowledge, aptitude, need or interest, would be able to acquire the same set of skills from a single training model. The low level of success of the first year of implementation suggested that the project would function at a higher level and produce greater results if the design were adapted. The adaptations relate to several learning theories: Constructivism, Cultural Mediation, Self-Determination, and Change Theory. Though some of these theories were developed specifically for child learners, their principles seemed to hold true for the adult learners in the StarTEC project.

<u>Constructivism</u> To a large degree learning to use technology requires the learner to acquire new information that includes signs in much the same way that language is learned and includes artifacts in parallel ways to learning to use tools. Constructivism purports that learning takes place both in isolation and as a social interaction and that both are necessary components for the permanent adoption of knowledge. The authenticity of the knowledge is determined for the individual by the ability to apply the knowledge to one's own experiences. Further, the individual is only likely to retain the knowledge if it can be connected or applied to experience. The StarTEC coordinators redesigned the training program at the end of the first year to include a flexible, multi-level, self-paced training schedule; personalized products that had professional relevance (e.g., electronic portfolio); and social constructs that encouraged the participants to interact (e.g., institutional leaders, trio workshops), Additionally, instead of teaching technology skills discretely, the training was redesigned to teach technology through integration into the curriculum. Once the boundaries between levels of expertise were removed and faculty were allowed to attend the training sessions that they most urgently needed in their own personal order, more faculty participated and experienced a higher level of achievement and satisfaction. More authentic products began to flow out of the sessions. Faculty reported higher levels of use of technology in their teaching. They also began to request a wider variety of training as they developed authentic questions about ways to use the knowledge they had obtained. In short, faculty constructed their own learning about technology based on their personal needs and experience and the needs and experience of their social/cultural community as schools of education.

<u>Cultural Mediation</u> If one considers the use of computer technology as a tool for learning, the parallels with Vygotsky's theory take on primary importance in

understanding how one can most readily adopt and adapt technology for personal and professional use. According to Vygotsky, learning is mediated by the individual's need to make meaning within social contexts. In doing so, the learner uses exterior objects of the culture in applied learning situations. This kind of learning appears to be internalized or mnemonically encoded more readily than more traditional (passive) forms of learning. The objects, as learning is acquired, take on the function of signs. Signs in human learning situations are constructs of complex knowledge and/or belief systems, a short-hand for allowing the human mind to capture many complex ideas. Vygotsky explains that once the signs or "pictures" are memorized, the indiviidual quickly begins to look for language or tools (external) to associate with them. Growth to the next stage is a short leap to internalizing the new information and creating new associations with previous constructs of knowledge already acquired. In this way new schema are built. The process is also spurred by external pressure in social situations.

Cognitive development occurs when individuals encounter external (cultural) problems, the perception of which sets in motion the need to learn (i.e., solve the problem). These encounters cannot usually be staged but must instead at least appear authentic for the most efficient process of learning to take place. "An organism internally prepared absolutely requires the determining influence of the environment in order to enable it to accomplish that development." (Vygotsky, 1929) Using social constructs or socially mediated learning situations, the StarTEC project was able to facilitate and promote the acquisition of computer technology integration in higher education faculty. For example, one institution created "learning circles"; another structured trios consisting of an education professor, a field supervisor and a student teacher. Since in the context of a professional program of study these constructs were authentic to the learning process, the participants readily embraced them as learning situations. In addition, the products of StarTEC training were directly linked to "real" professional activities, such as professional portfolios and classroom curriculum required to function effectively in a social structure.

Self-Determination The results of the StarTEC project can be understood also in terms of Self-Determination Theory. Self-Determination Theory, as defined by E. L. Deci in the 1970's, professes that individuals are more strongly motivated toward any achievement by internal drives and needs if the locus of control for advancement remains within the individual. To the contrary, extrinsic rewards remove the locus of control to some exterior source. This loss of control can have the effect of reducing motivation.

The StarTEC project was originally planned to offer monetary stipends to those faculty who participated. However, after one year of operations the project coordinators found that most faculty valued their time and other commitments such as teaching, research, and special projects more highly than the monetary reward, which resulted in minimal participation in StarTEC. So the project coordinators looked for training content that could enhance and ease the faculty's workload. In the second year trainings focused on integrating technology into the education courses that faculty were teaching. Faculty were invited to bring their lecture materials to class to convert to Power Point, to adapt to Inspiration (mapping software), and to illustrate with iMovie. The coordinators also decided that they could increase interest in the project by identifying a need within the realm of the faculty's valued work that technology could fill. Faculty working toward tenure review were invited to learn how to create electronic portfolios. Supervisors were asked to interact with K-12 faculty and teacher candidates using technology to facilitate the student teaching process. Though participants were happy to accept their stipends, they no longer questioned their own time investment, and many fulfilled more hours than were required to earn the stipends. A few advanced users at each institution were even motivated to take on the role of Technology Leaders by providing technical assistance and training for beginning users, literally changing the culture of their school of education. All of the activities mirror the intrinsic motivation factor of Self-Determination Theory by meeting internal needs to communicate and produce quality work and professional products. Faculty's diverse needs for technology were also addressed by flexible and self-selected training programs. Participants were not required to attend trainings in any particular order or for any particular length of time but instead could "design" their own training program to meet their own needs. Online instruction was also offered. This kind of rotating or revolving training schedule proved to be the most successful for the project.

Change Theory The final theory that this paper will address to analyze the StarTEC project is Change Theory according to Michael Fullan. StarTEC was originally conceived as a three year project that would train a cohort each year for three years, striving ultimately for training a large total number of faculty. Cultural change within the schools of education and change in individual processes for work production were not considered as factors until progress was assessed at the end of the first year. At that time the coordinators began to see that institutionalized processes for communicating, evaluating, and production would require time to change. The change began with small, simple differences (e.g., sending all communications out to faculty electronically and then requiring faculty to respond electronically). Even small changes initially met with resistance. Eventually, through symbiotic agreement, the use of technology within the schools of education moved from personal use to professional use to professional requirement which certainly went beyond the original goal of the project to create models for meeting the technology standard in teacher education programs.

Fullan talks about developing learning communities to sustain change (239). The grant guidelines required a plan for sustainability. StarTEC achieved this by developing learning communities that extended out from teacher preparation to academic departments and local K-12 schools. Examples are the trios and cohort groups at UCR, the K-12 academies at CSU, Fresno and USF, and the learning circles at CSU, Bakerfield. Articulation between teacher preparation and student teaching was strengthened when faculty and supervisors received the same training in integrating technology. The institutions that built strong partnerships for change experienced greater growth within their schools of education in the use of technology. Their insights were richer and more numerous. Naturally their resources were greater. By sustaining a program of technology integration in the schools of education for over three years, each institution was able to change the institutional culture.

Individual change was guided by Apple Computer's Evolution of Thought and Practice (attachment). Beginning users first had to learn the language of technology to be able to express their challenges and needs. As they found new ways to deliver instruction that were more successful, faculty were motivated to learn more. The critical role of the project was to identify, preferably, personal needs which often were attached to higher levels of motivation that professional needs. In addition, instead of training faculty for one year and then beginning with a new cohort each year, the coordinators found that many participants wanted to return each year to repeat training or learn higher levels of technology use. Learning curves varied widely with some participants taking all three years to reach an advanced level and some moving into roles as trainers themselves by the beginning of the third year. But institutional support of the project was critical to the progress and interest of the participants. In some cases that support had to be actively courted.

ATTACHMENTS

1. Apple Computer Evolution of Thought and Practice (ETAP)

2. Sparrow Web Introduction

3. ISTE/CTAP/CCTC Standards Matrix

Attachment 1

The Evolution of Thought and Practice for Colleges of Education

Entry

GETTING STARTED Ø Beginning use of word processing, email, web surfing for resources

Adoption

TEACHER
PRODUCTIVITY
Ø More sophisticated use of word processing, email, file transfer
Ø multimedia presentations, and web pages (PowerPoint)
Ø may post files for download
Ø early use of web-based systems (Blackboard.com)

Adaptation

STUDENT
PRODUCTIVITY
Ø Lecture notes online
Ø More full-featured use of web-based systems
Ø Text-based transfer of knowledge using technology
Ø Instructor-defined parameters of assignments, including technology-based projects
Ø Attempts to recreate good classroom experiences, including text-based representation of knowledge,
provoking questions, engendering discourse between the teacher and the learner, all using online tools
(Blackboard.com)

Appropriation

COLLABORATIVE
PRODUCTIVITY
Ø Multiple files, programs, activities; project-based learning
Ø Interacting with learners and experts outside the traditional university class
Ø Community of learners; change in the notion of expertise and who makes decisions; developing and
empowering new expertise, distributed decision-making
Ø Facilitated learning
Ø Leveraging technology to promote higher order thinking – learner-created challenges, student-construction
knowledge

Ø Rethinking curriculum

Innovation

NEW LEARNING
ENVIRONMENT

Ø Changing the teaching and learning environment (not just for specific projects), including time, space,
and the nature/roles of participants

Ø New approaches to curriculum inspired by faculty and students

Ø Free exchange of ideas among faculty

Ø Systemic change by program, department, school/college

Attachment 2

Introduction to Sparrow Web™: Community Shared Web Page

XEROX CORPORATION

PALO ALTO RESEARCH CENTER

Introduction

The universality of the Internet makes it a practical platform for collaboration. Web pages are accessible by any browser, and browsers are common on every computing platform. However, it is awkward to use the Internet as a collaborative working environment because current Web pages are strongly biased towards reading previously authored documents. Web pages are usually treated as published documents that are owned and modified by the original author.

Sparrow Web™ facilitates a different genre of Web page: The Collaborative Web Page. Like any Web page, a Collaborative Web page is originally crafted by a single author who defines the initial content, scope, and form of the document. But unlike other Web pages, a Sparrow Web page may be easily modified by any interested contributor.

For page authors, this easy-to-edit capability frees them from the current need to use information systems or HTML programming people to create new pages. For end users, Sparrow Web reduces the barriers to write to Web pages. Therefore, Web pages become more useful as they grow and change with new information. Writing to the Web becomes as easy as reading from the Web.

Collaborative Web Pages

A Collaborative Web page is a document that provides information of interest to a community whose ownership is shared by that community. Sparrow Web is architected with a focus on groups, i.e. a many-to-many workflow system, and supports fine-grained inputs such as comments, annotations, activity logs, and responses to queries. Sparrow Web allows contributors to add small bits of unstructured information to a Web page in a structured fashion.

In contrast, regular Web pages are owned by their authors. Changes to the content are restricted to a defined, small number of "administrators" and require significant effort, i.e. end users cannot copy and create new pages on the fly. Another limitation of most Web applications is their page-orientation, i.e. each interaction yields a new page with new information and/or new controls.

A Sparrow Web editing experience is intended to seem like interacting with a traditional "desktop" application in which the user directly manipulates parts of documents. The Web page author initially creates the entire page and adds Sparrow Web capability to the parts he wishes to have people contribute to. Sparrow Web then allows editing of specific parts of Web pages. Edit icons are attached next to modifiable sections, one icon per section. By clicking on the edit icon, items may be immediately edited/appended, thereby forming growing lists of items. Note that page layout information is protected from inadvertent modifications by individual contributors.

Lightweight Editing Features

Some features of Sparrow Web that contribute to being lightweight are:

- Editing directly in the web browser
- Editing one item at a time
- Editing in-place in the document
- Field-structured editing
- No need to know (or see) any HTML

- No need to explicitly lock the file or item

Sparrow Web handles fine-grained concurrency behind the scenes. The user is only required to intervene on rare occasions when an item has been simultaneously edited.

Advanced Features

Sparrow Web comes with an API that allows a Sparrow Web page to be treated programmatically as a database. In addition, a scripting mechanism enables programmatic extensions to the system's functionality. Using the Sparrow Web DB API, scripts have been used to automatically copy content from one Sparrow Web page to another, eliminating the need for entering the same information in multiple pages (e.g., one version inside a firewall, and another version outside a firewall). Scripts have also been used to specify when content should be published, and then automatically publish the content from one page to another based on the specified schedule.

Sparrow Web pages can be secured with built-in access control, or it can be used with the Xerox DocuShare web repository. By putting Sparrow Web pages in a DocuShare repository, individuals and groups can take advantage of document management functionalities such as versioning, and meta-data & full-text searching, in addition to DocuShare native access control.

User Applications

Sparrow Web list pages have been used for activities such as:

- Project management
- Course information management
- Software process management

And, other general purpose communications such as:
- Managing shared to-do lists
- Announcing upcoming community events
- Gathering signatures for petitions
- Recording software purchases and licenses
- Tracking new web technologies
- Reporting bugs and feature requests
- Listing recently published papers

· Interview schedules

System Requirements

Either a Sun SPARCstation with SunOS5.6 or later with network connectivity, or an IBM compatible computer with at least a Pentium III-class processor and running Windows NT/SP5 or Windows 2000 operating system, with network connectivity. (Debian Linux has been shown to work - follow the Solaris installation instructions.)

Conclusion

Interactions with a Sparrow Web page are modeled after familiar desktop conventions such as editing in dialog boxes. Sparrow Web frees contributors from having to know HTML, having to know where the page is stored on the file system, and having to know how they should format their additions to the page. Keeping the both page context and the Web browser context intact minimizes the disruption of the user's experience.

Sparrow Web's lightweight editing is intended to make the Web a more useful medium for collaborative work. Allowing editing within the Web page makes it easier for people to contribute to the page, encouraging Web pages to become community-shared documents.

Writing to the Web becomes as easy as reading from the Web.

Attachment 3

CORRELATION OF THE ISTE AND CALIFORNIA TECHNOLOGY STANDARDS FOR TEACHERS: A *DRAFT* DOCUMENT

CA Technology Standard Factors to Consider http://www.ctc.ca.gov/ceap/technology_pamphlet.pdf	ISTE NETS for Teachers: Standards http://cnets.iste.org/pdf/page08.pdf		Planning & Designing Learning Environments and Experiences					Teaching, Learning and the Curriculum				Assessment and Evaluation			Productivity and Professional Practice				Social, Ethical, Legal and Human Issues				
	I A	I B	II A	II B	II C	II D	II E	III A	III B	III C	III D	IV A	IV B	IV C	V A	V B	V C	V D	VI A	VI B	VI C	VI D	VI E
Level I: Preliminary Credential Each Candidate:																							
Demonstrates knowledge of current basic hardware and software terms	●																						
Demonstrates competency in the operation and care of hardware	●																						
Implements basic troubleshooting techniques for computer systems and peripherals	●																						
Demonstrates knowledge and understanding of legal and ethical issues concerned with the use of computer-based technology	●																		●				
Demonstrates knowledge and understanding of the appropriate use of computer-based technology in teaching and learning			●					●							●							●	
Uses computer applications to manage records	●											●	●										
Uses computers to communicate through printed media	●										●				●		●	●					
Interacts with others using email	●														●	●	●						
Is familiar with a variety of computer-based collaborative tools	●														●	●	●	●					
Examines a variety of current educational digital media and uses established selection criteria to evaluate materials	●				●																		
Chooses software for its relevance, effectiveness, alignment content standards, and value added to student learning	●		●	●																			
Demonstrates competence in the use of electronic research tools	●	●													●								
Demonstrates the ability to assess authenticity, reliability, and bias of data gathered	●																		●				
Identifies student learning styles and determines appropriate technological resources to improve learning									●		●									●			
Considers the content to be taught and selects the best technological resources to support, manage, and enhance learning				●		●	●			●	●		●								●	●	●

This document is available in PDF format at: http://tlrsu.end.edu/techstandards/ as of 11/15/00

BEST COPY AVAILABLE

REFERENCES

Cole, M., Wertsch, J. (1994) "Beyond the Individual-Social Antimony in Discussions of Piaget and Vygotsky" Department of Psychology, Massey University, New Zealand

Fullan, M. (2001) *The New Meaning of Educational Change,* New York, Teachers College Press

Pajares, F. (2001) Self-Determination Theory. "Controversies—The Rewards of Controversy" Retrieved January 3, 2003, from http://www.emory.edu/EDUCATION/mfp

Vygotsky, L. (1929) "The Problem of the Cultural Development of the Child" Retrieved January 3, 2003, from http://www.marxists.org/archive/vygotsky/works/1929/cultural_development.htm