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ABSTRACT

Through multiple lenses, this paper describes the efforts of the Georgia Systemic Teacher Education Program (GSTEP) to redefine teacher induction. The macro level illustration details a review of existing teacher induction models focusing on the lack of technology mention in existing national models. A meso level illustration of two GSTEP partners as campuses in the southern region of Georgia describes existing technology infusion efforts. The final cut is a micro level analysis of one College of Education Department involved in teacher preparation efforts to determine to what extent preservice students describe themselves as meeting national technology standards. The discussion describes the technology-related components of a new induction model and the implications for implementation and further study. (Contains 60 references.) (Author/AEF)

Teacher Induction and Technology Integration: Is there a critical element missing in existing induction models?

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Abstract

Through multiple lenses we describe the efforts of the Georgia Systemic Teacher Education Program (GSTEP) to redefine teacher induction. The macro level illustration details a review of existing teacher induction models focusing on the lack of technology mention in existing national models. A meso level illustration of two GSTEP partners as campuses in the southern region of Georgia describes existing technology infusion efforts. The final cut is a micro level analysis of one College of Education Department involved in teacher preparation efforts to determine to what extent preservice students describe themselves as meeting existing national technology standards. Our discussion describes the technology-related components of a new induction model and the implications for implementation and further study.

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Introduction

Existing teacher induction models inadequately address the technology competencies required of our teachers. This paper describes the process a partnership of three universities, policy-making organizations, and school systems applied as they reviewed induction models in an effort to design an induction framework for the state of Georgia. We provide an argument for including technology as a broad principle encompassing specific indicators of teacher competencies defining effective use of technology by teachers to support teaching and learning. The result of our effort is a model for teacher preparation programs based on the existing research, competencies established by agencies concerned with technology in teacher preparation, and mandates from policy-setting organizations.

Purpose

The existing body of research reflects the importance of technology in teacher preparation programs (Handler 1993, Hill and Somers 2000, Wilson 1996, Nicaise and Barnes 1996, Northrup and Little 1996). More than 300,000 computers per year are added to our schools, but preservice training programs continue to ignore the needs of future teachers, other than offering a course or series of courses to learn technology skills (Beaver 1990, Brook 1989, Roblyer 1994, Wilson 1996). In order for our teachers to reach a level of generalization with technology, where they are able to take existing learning units and adapt their knowledge of technology to improve the engagement of the learner and facilitation of improved student achievement, technology must be infused into the continuum of teacher preparation programs. There must be a progression from awareness to a target level of generalization where the teacher is able to apply knowledge and skills to design technology supported and immersive learning environments. The fact that induction framework models ignore this need of our beginning teachers must be resolved.

Demands on Teaching

The quality of the teaching force in Georgia and the entire country is central to the improvement of P-12 schooling. Haselkorn and Harris (1998), in a nationwide sample of adults, found that 55% of adults surveyed believe that the greatest influence on the learning of students is "the quality and caliber of their teachers." Reports from the profession, such as the NCTAF (1996), also cite the significance of teachers as fundamental to school improvement. The compelling evidence compiled by the Education Trust also supports the need for quality teachers in every classroom. Data they have collected indicate that students who have several effective teachers in a row make dramatic gains in achievement, while those who have ineffective teachers in a row lose significant ground from which they may never recover. This organization reports a Boston study where students who achieved at similar levels in the third grade were separated by as much as 50 percentile points three years later depending on the quality of the teachers to whom they were assigned (Haycock, 1998).

Teachers across the nation are being asked to rethink both what they teach and the ways in which they teach it in order to achieve results. Yet, according to studies, only 28% feel prepared to use performance assessment, only 41% deem themselves competent to implement new teaching methods, and only 36% consider themselves well prepared to implement new standards. Teachers are also confronted by students who differ fundamentally from those of even ten years ago. Only 20% of them feel well prepared to work with the various cultures and student needs prevalent in today's classrooms (National Center for Educational Statistics, 1999). These statistics reflect the same pressures and feelings of inadequacy of Georgia teachers--especially since state legislators linked school achievement to teacher performance and abolished tenure for new teachers during the last legislative session.

State Illustration

Georgia ranks 7th among all states in population. Our economy and population have boomed for over two decades, particularly in the metro-Atlanta area. Corporations such as Coca-Cola, Home Depot, Equifax, CNN and UPS call Atlanta home. However, not all regions of the state have attracted leading industries or experienced the phenomenal growth occurring in the metro-Atlanta area. Some areas of both north and south Georgia, major service areas of the partnership, have experienced limited economic, social, and educational opportunities for their residents. Examining regional economic and educational characteristics paints a different picture than the affluent metro-Atlanta area.

For example, the on-time high school graduation rate for Athens-Clarke County, the home of UGA, is 54.3% compared to the state average of 63.4%. Of the 23% of adults 25 years or older not completing high school, 46% are African-American. The Hispanic population is the fastest growing segment of Clarke County (77% increase between 1990 and 1998). The southernmost 41 counties of Georgia contain 30% of the total area of the state, yet they represent only 10.9% of the state population. The average family income is $17,995, almost $5,000 less than other geographical areas. Over 28% of the families who reside in south Georgia have incomes under $10,000, and 43% of the African-American families live below the poverty level.

An examination of educational information also reflects the plight of the southern region where both ASU and VSU are located. Like Clarke County, the high school dropout rate is greater than the rest of the state. This loss of human potential leads to a smaller percentage of citizens prepared for college and a greater portion of citizens unprepared for the work force. More than 19% of the area's population age 25 years or older have less than an 8th grade education. An average 42.8% of the area's citizens older than 25 do not have a high school education. The infusion of improved educational support for this region is desperately needed in order to improve the quality of life of the area's citizens and to attract industry and businesses.

Overall, standardized test scores of Georgia students also paint a bleak picture. Georgia students typically score near the bottom in standardized national examinations such as the SAT. (The state average was 33 points below the national mean in 1998.) African-American students in particular have had difficulty on the SAT. Although they make up 43% of the student population in Georgia, fewer than 300 African-American students statewide made 1200 or higher on the SAT, the average SAT expected for entering freshmen at UGA this fall. While data on other state tests indicate that student achievement in the state is improving slightly (ITBS scores of 3rd, 5th, and 8th grade students have been averaging fractionally above the 50th percentile), there remains a considerable mismatch between Georgia's economic prosperity and its educational accomplishments, especially in areas represented by GSTEP partners.

State government actions have established computer related technology to improve access and capacity in schools as a priority. The legislature passed HB 1187 requiring all teachers to meet a technology certification requirement by 2006 and approved funding for a technology specialist per every 1,100 students. Previously schools could receive funding to have one person per four school buildings. Nearly all of the 180 school systems have at least a T1 line for Internet connectivity. 53% of schools have more than 50% teachers using the Internet for instruction (Jacobson, 2001).

Needs Assessment Results

To gain insight from stakeholders for improving education in GSTEP service regions and to prepare our USDE proposal, an extensive needs assessment was conducted that utilized surveys, focus group interviews, and town hall meetings. Large and small-scale focus group meetings were held at regional sites in Athens, Valdosta, and Albany. Approximately 165 people attended including professors from Arts and Sciences (A&S) and Education (COE) representing universities and two-year institutions, teachers and administrators from local schools, consultants from Regional Education Service Agencies (RESAs), business persons, beginning teachers (BTs), and community members. A consensus building process was used during these sessions to build our proposal. Utilizing a needs assessment instrument created exclusively for the GSTEP proposal, attendees rated the current status as well as the importance of certain knowledge, skills, and experiences in the preparation of teachers. Both processes established that education of pre- and inservice teachers was a critical priority.

Specifically, needs assessment analysis identified the following needs that we will address meaningful collaboration among partners, induction support for BTs, more experience in communities and schools, especially those considered high-need, improved teacher recruitment, and more use of technology-rich environments. Technology is transforming our society, but education is not advancing at the same pace as other sectors. Through GSTEP, we must better utilize technology to communicate, to enable lifelong learning by BTs and experienced teachers, to improve student learning and achievement, and to help BTs design, implement, and assess learner-focused classrooms.

Georgia's Induction Effort

In response to these and other needs, several institutions within Georgia have created the Georgia Systemic Teacher Education Program (GSTEP). GSTEP is a collaborative partnership of the University of Georgia, Valdosta State University, Albany State University, 11 partner school districts, businesses, and state agencies working toward the systemic reform of teacher education in Georgia with a central focus on impacting P-12 student achievement. Across each institution, GSTEP is a partnership of P-12 educators, Arts and Sciences faculty, and College of Education faculty (Padilla, et al., 2000). Using a network of collaborative teams, we are undertaking the "redesign of teacher education." We are creating a system to insure that every student entering teacher education has extensive early experiences working with and in diverse families and communities. We are developing a resource framework of teacher preparation to guide and support the experiences of our students from their entry into the teacher education program and continuing throughout their first two years of teaching. Additionally, we are creating a mentoring system to support teacher candidates and beginning teachers. These efforts are designed to ensure that teacher preparation graduates can bring all students to high levels of achievement. Our goals are as follows:

Goals and Objectives

Through GSTEP, we will achieve the following three overarching goals:

Goal I: Establish seamless, high quality learning opportunities and support for beginning teachers, especially in Georgia's high-need schools. Committed partners are developing a six-year experience encompassing all aspects of beginning teaching education from freshman year through the second year of teaching. Teams at each higher education institution are at work improving beginning teachers' (BTs') content, pedagogical, and technological knowledge and skills by building upon projects currently underway in the areas of Contextual Teaching and Learning (Lynch & Padilla, 1998), content standards development and alignment (Collias, 2000), and infusion of technology into teaching and learning (Recesso and Venn, 2000). As a result, we are increasing and improving the quantity, quality, and variety of clinical experience, ensuring that students spend extended, carefully supported time in high-need schools and communities. We are also creating an induction program that connects each graduate with a trained in-school mentor and to resources and individuals in other schools and higher education. Throughout all phases of GSTEP, technology is being used as a conduit for communication, support, and resources.

Goal II: Prepare BTs to bring all learners to high levels of achievement. Educational change demands that research-based strategies be used to ensure that all students achieve at higher levels. Through course work, clinical and induction experiences, and participation in GSTEP networks, BTs are learning to design, assess, and extend student learning in meaningful and productive ways, taking into account national standards, the unique characteristics of high-need schools, and the previous experiences of the learners. Specifically for this goal, we are creating disciplinary teacher networks and focusing professional development of all partners on five critical need areas: culturally responsive teaching, assessment, contextual teaching and learning, technology, and building active, intellectually engaging classrooms. As a result of the GSTEP participation, BTs will be able to document increased student achievement in their classrooms.

Goal III: Create systems for policy, professional development, dissemination, and evaluation. To ensure that GSTEP accomplishes its two major goals and systemically changes teacher education, we have begun to study and implement policy related to teacher education. As recommended by authorities seeking to improve teacher quality, and with full support of our university provosts/presidents, we are revising the reward structure for college faculty and creating incentives for their closer involvement with public schools (USDE, 1999). On-going professional development training will also be a cornerstone of GSTEP, for the continued growth of all partners is critical to our program's success. Professional development programs bring together partners from public schools, colleges, state agencies, and our communities and address the specific needs of constituents to improve teacher quality and student learning in Georgia. These interactions are continuous (not "one shot" events) as advocated by experts in professional development (WestEd, 2000). Our progress is also being documented, and all partners are being held accountable for significant change and improvement through substantive evaluation.

The Georgia Systemic Teacher Education Program (GSTEP)

The Georgia Systemic Teacher Education Program (GSTEP), in part, is establishing the Teacher Resource Framework as a new induction model and the Teacher Resource Bank as the web-based portal tightly aligned to support the Framework.

> "The Framework is organized around six elements of teaching including content and curriculum, students and their learning, learning environments, planning and instruction, assessment, and professionalism. Each element will include indicators, each of which presents a characteristic of exemplary teachers. Each indicator is followed by descriptors that provide a rich, clear, observable picture of what teachers are doing when they enact the indicators. Resources provide links into a myriad of resources (graduate and staff development programs, opportunities to learn through experience, print and web resources, videos, research literature, etc.) that teachers and their mentors or supervisors can access in order to develop teacher-driven, next-step, self-improvement plans across their careers. Given the ultimate goal of improving student learning by improving teaching, the framework includes Student Evidence to indicate some of the ways that teachers could document their impact on student learning. Finally, correlations reveal how the Framework components link to other state and national efforts to conceptualize and improve teaching. While the six elements are presented separately to make it easier to identify and locate resources, it is not logical to look at teaching unless all six aspects are considered together. We hope that users will envision these elements as a layering effect in which each new element adds depth and richness to the others. Real teaching decisions and actions involve complex combinations of these elements, indicators, and descriptors. Therefore, users should consider multiple aspects of any question, problem, need, or issue and search the framework for all potentially relevant resources." (direct quote Ross, 2001)

Directly aligned with the Teacher Resource Framework effort is a technology-based initiative. The intent of the Teacher Resource Bank is to meet the needs of pre-service and induction teachers and improve P-12 student learning. By focusing on the establishment of a statewide system that will support the pre-service and induction teacher in designing, implementing, and assessing teacher-facilitated and learner-focused classrooms, more teachers will experience success in the classroom.

Valdosta State University received a U.S. Department of Education Preparing Tomorrow's Teachers for Using Technology Implementation Grant to plan, design, and build the Teacher Resource Bank. Through the efforts of the GSTEP project we will replicate and expand Valdosta's efforts as a statewide resource. The web-based system provides access to technology supporting a variety of educational components. These components include personal productivity, communication, instructional delivery, and the use of technology as a cognitive tool for learners.

Technologies such as online learning systems, Internet web pages, video streaming, interactive learning environments, and online databases are used to support the pre-service and induction teachers. The online database systems (e.g. Lotus Domino) are a critical component for compiling and disseminating curriculum, websites, classroom materials, video, audio and other resources. Pre-service students practice with the Teacher Resource Bank as they progress through their classes and student teaching experience. The Teacher Resource Bank will then provide support for the student teacher and induction teacher enhancing their first experiences in the classroom. The components of the Teacher Resource Bank can be seen at www.teacherresourcebank.com.

While 46 school systems in Georgia have trained all of their teachers to use technology (Jacobsen, 2001), we are still only training teachers to a level of technology awareness. Teacher induction models serve as conceptual frameworks for colleges of education. For example, the INTASC standards are the foundation for the College of Education at Valdosta State University. For teachers to reach a target level of generalization as applying knowledge of technology to new areas of teaching and learning we needed to know to what extent existing induction models addressed technology needs of teachers.

The Parallel Effort: Review of Existing Teacher Induction Models

The process of developing an induction framework infused with technology began with two parallel efforts. We wanted to determine to what extent preservice and inservice teachers describe themselves as having knowledge to integrate technology, the skills to use technology, and can provide evidence in practice of integrating technology into their teaching. We also systematically reviewed existing teacher induction models. We gathered copies of the Washington, Connecticut, Santa Cruz, Danielson's A Framework for Teaching, National Board, and INTASC principles. Other documents reviewed included the Georgia Board of Regents Principles, Georgia House Bill 1187 Education Reform Act, and NCATE accreditation requirements. All of the documents were analyzed along a matrix of common competencies resulting in the grouping of what we called principles. The principles would be detailed further with indicators and descriptors of what actions an effective teacher is able to do in order to facilitate learning for high student achievement.

During the review process we found there to be little mention of technology (See Figure 1). Some models did not mention it at all, others had intermittent mention of it throughout some of the domains, and two had brief statements. As we began to draft our

Figure 1. Induction Models and Teacher Technology Competencies

Organization or Affiliation	Model	Technology as own domain?	Location of technology competencies	Competency statements
Association of Supervision and Curriculum Development	Pathwise: A Framework for Teaching	No	None	None
State of Washington	Framework for Proficient Teaching and Student Learning:	Yes	Criterion G: Integration Technology into Instruction and	-Critically evaluates and uses available technology as a teaching tool -(Proficient) Has knowledge of available technology in school and district of instruction, critically

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	Measuring Up to Professional Certification		Assessment	evaluates it and uses this knowledge to integrate the technology into teaching strategies and as an assessment tool
State of Connecticut	Connecticut's Common Core of Teaching	No	Foundational Skills and Competencies	II. #5. Teachers use effective verbal, nonverbal, and media communications techniques which foster individual and collaborative inquiry (Content) #4b. learning about and using computer and information technology as an integral part of teaching their discipline(s) #4d. being aware of the evolving nature of subject matter knowledge and the need for keeping abreast of new ideas and understandings within one's discipline, including the impact of technology and information resources on the nature of teaching, communications and the development of knowledge (Planning) #1b. selecting appropriate materials- including a wide range of technological resources- to help students find information, interpret the quality of sources, and effectively synthesize and communicate information
University of California at Santa Cruz				
National Council for Accreditation of Teacher Education	Professional Standards for the Accreditation of Schools, Colleges, and Departments of Education	Yes	-A Vision of the Teacher for the 21st Century -Pedagogical Content Knowledge for Teacher Candidates -Professional and Pedagogical Content Knowledge and Skills for Teacher Candidates -Professional Knowledge and Skills for other School Personnel -Design, Implementation, and Evaluation of Field Experiences and Clinical Practice -Modeling Best Professional Practices in Teaching	-Prepare candidates who can integrate technology into instruction to enhance student learning -candidates should be able to integrate technology into instruction effectively -conceptual frameworks reflect the unit's commitment to the integration of technology to enhance candidate and student learning -Committment to Technology: The unit's conceptual framework reflects the unit's commitment to preparing candidates who are able to use educational technology to help all students learn; it also provides a conceptual understanding of how knowledge, skills, and dispositions related to educational and information technology are integrated throughout the curriculum, instruction, field experiences, clinical practice, assessments, and evaluations.

			-Unit Facilitation of Professional Development -Unit Resources Including Technology	
Council of Chief State School Officers	Interstate New Teacher Assessment and Support Consortium Standards (INTASC)	No	Eluded to in standard #6	#6. The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.
National Board for Professional Teaching Standards	Standards	No	None	None

induction model we debated the placement of technology in the framework. The discussion was formed by two opposing arguments. One perspective was to fold technology into the framework as an indicator of each element. In this case technology would be a common thread among most or all of the elements. The other perspective was to have a technology element that would be concretely aligned with all of the other elements. The decision to have technology as its own broad principle and as specific indicators of the six elements was based on the level of priority given to teacher technology competencies by NCATE, the recent work of ISTE, the Georgia House Bill 1187 Education Reform Act, Georgia Teacher Technology Standards CEO Forum on Educational Technology, the overall importance technology plays in our everyday lives, and the existing body of research (See Figure 2).

Figure 2. Technology Competencies Established by Technology Policy Organizations

Organization	Document Title	Teacher Preparation or Inservice?	Statements
International Society for Technology in Education	National Educational Technology Standards for Teachers	Preservice	-demonstrate a sound understanding of the nature and operation of technology systems -demonstrate proficiency in the use of common input and output devices; solve routine hardware and software problems; and make informed choices about technology systems, resources, and services -use technology tools and information resources to increase productivity, promote creativity, and facilitate academic learning -use content specific tools to support learning and research -use technology resources to facilitate higher order and complex thinking skills, including problem solving, critical thinking, informed decision making, knowledge construction, and creativity -collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works using productivity tools -use technology to locate, evaluate, and collect information from a variety of sources -use technology tools to process data and report results -use technology in the development of strategies for solving problems in the real world -observe and experience the use of technology in their major field of study -use technology tools and resources for managing and communicating information -evaluate and select new information resources and technological innovations based on their appropriateness to specific tasks, use a variety of media formats, including telecommunications, to collaborate, publish, and interact with peers, experts, and other audiences -demonstrate an understanding of the legal, ethical, cultural, and societal issues related to technology, -discussion diversity issues related to electronic media -discuss the health and safety issues related to technology use
State Of Georgia	Regents' 1998 Principles and Actions for the Preparation of Educators for the Schools: 2001 Refinements	Preparation	Candidates: -are able to use telecommunications and information technologies as tools for learning and to meet Georgia Technology Standards for Educators as required by the Professional Standards Commission. -meet the Georgia Technology Standards for Educators -use technology to meet the individual learning needs of students, teachers, and administrators -increase student-learning time, as needed, using flexible schedules, structures, and technology

			-use state-of-the-art technology practices from business and industry to effectively and efficiently manage resources, planning, record keeping, and evaluation of schools and systems
	HB 1187. A Plus Education Reform Act of 2000	Preparation and Inservice	Mandates that holders of a renewable certificate must pass a computer skills competency test before they can receive certification renewal. Successful completion of the phase one InTech model training at a state educational technology training center or a State Board of Education approved redelivery team shall be acceptable for certificate renewal purposes.
	Professional Standards Commission: Georgia Technology Standards for Educators	Preparation and Inservice	-Demonstrate introductory knowledge, skills and understanding of concepts related to technology -Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies -Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners -Apply current research on teaching and learning with technology when planning learning environments and experiences Identify and locate technology resources and evaluate them for accuracy and suitability -Plan for the management of technology resources within the context of learning activities -Plan strategies to manage student learning in a technology-enhanced environment -Facilitate technology-enhanced experiences that address content standards and student technology standards -Use technology to support learner-centered strategies that address the diverse needs of students -Apply technology to develop students' higher order skills and creativity -Manage student learning activities in a technology-enhanced environment -Apply technology in assessing student learning of subject matter using a variety of assessment techniques -Use technology resources to collect and analyze data, interpret results and communicate findings to improve instructional practice and maximize student learning -Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication and productivity -Use technology resources to engage in ongoing professional development and lifelong learning -Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning -Apply technology to increase productivity -Use technology to communicate and collaborate with peers, parents and the

			larger community in order to nurture student learning -Model and teach legal and ethical practice related to technology use -Apply technology resources to enable and empower learners with diverse backgrounds, characteristics and abilities -Identify and use technology resources that affirm diversity -Promote safe and healthy use of technology resources -Facilitate equitable access to technology resources for all students
CEO Forum on Education and Technology	Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education	Teacher Preparation	-National accreditation standards for schools of educa-tion should require that schools of education prepare new teachers and administrators to integrate technol-ogy into the classroom by 2000; -Schools of education should provide faculty with the tools, incentives, and on-going professional develop-ment they need to integrate technology into the teacher training curriculum by 2001; -New teacher and administrator licensure and certifica-tion programs should require proficiency integrating technology into the curriculum by 2003; and -Technology funding for schools of education should be increased. -Strategic planning incorporating technoogy, funding for technology, technology appropriately integrated in courses in all departments; hiring, tenure, and promotion of faculty with technology research and teaching expertise, program guided by NCATE technology integration standards, partnerships with K-12 schools around technology, technology in field experiences and student teaching, -understanding and use of technology to enhance teaching and research, understanding and use of technology to maximize student learning

We leave the macro level discussion of national induction models and state level induction efforts for the moment to focus on one service region within the state of Georgia. The case illustrations establish the progressive efforts of two institutions to infuse technology into teacher preparation programs. We are setting the stage for a deep cut at one department's efforts to infuse technology and a final discussion about a new teacher induction model infused with technology.

Service Region Illustration

South Georgia, the Valdosta State University (VSU) and Albany State University (ASU) service region, presents some unique challenges when considering the preparation of personnel to teach children. South Georgia reports a higher than average incidence rate of children identified with or at-risk for disabilities associated with poverty and unemployment. In the 1990, census, 25 out of 38 counties in the VSU service region reported greater than 25% of the residents had incomes under $10,000. Ethnic diversity exists and the majority of families living in poverty are nonwhite. Resources, both financial and personnel, are limited. Most of the small towns have little industry and no economic diversity. The College of Education draws its population primarily from the surrounding 41 counties, which represent 34 percent of the total area of the state and contain 12 percent of the state's population.

Valdosta State University Teacher Preparation Efforts

The College of Education (COE) at VSU proudly maintains a commitment to providing an education for future professionals in rural South Georgia. Acting as a learning community, the COE strives to meet the needs and aspirations of the population it serves. The COE is committed to using standards as a conceptual framework (INTASC) to ensure that all aspects of its operation contribute significantly to developing professionals of the highest caliber who are prepared to meet the challenges of providing services to enrich the lives of a diverse population. Mutually agreed upon and adopted, sets of standards are used by faculty members and administrators to develop a shared vision of professional practice. Standards guide the College of Education mission and goals as well as planning for continuous improvement (Mission Statement). Two of the 10 principles specifically identifies the use of technology as critical to the training of preservice teachers. Principle 4: The teacher understands and uses a variety of instructional strategies, including the use of technology, to encourage students' development of critical thinking, problem-solving, and performance skills. Principle 6: The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques, including technology, to foster active inquiry, collaboration, and supportive interaction in the classroom. As stressed by the U. S. Department of Education (1999), "future teachers should learn with these modern technologies integrated into the postsecondary curriculum by faculty who are modeling technology-proficient instruction, particularly in those courses where they acquire the subject area expertise they will use in the classroom." (p. 22). No longer do we see technology necessarily as being a stand-alone but technology should be infused into subject content areas especially when we are addressing Principle 4 (listed above) in our undergraduate teacher education program.

Technology Commitment

Valdosta State University and in particular the COE have invested in and supported both a technology rich environment as well as faculty development activities to enhance the effective use of technology into preservice coursework. A Georgia Board of Regents Educational Technology Training Center (ETTC) is housed in the COE. The Georgia Project for Assistive Technology has located an assistive technology specialist in the COE. This person works collaboratively with ETTC, and individual departments within COE to support the infusion of assistive technology (AT) into preservice training as well other professional responsibilities to Georgia Project for Assistive Technology. The School of Education has a wealth of computer resources. Besides four computer labs containing over 100 Compac, IBM, and Macintosh computers, ten classrooms have been designed in a distributed model. These classrooms each with a minimum of five computers in addition to a teacher presentation computer and a 35 inch television monitor, are connected to the four file servers in the Education Center. The Department of Special Education and Communication Disorders is housed in a new state-of-the-art facility that includes two general use computer labs, an assistive technology lab, a 10 suite electronically advanced video/audio wired speech/hearing clinic, a speech science lab, 2 audiology labs and desktop based computer technology for each faculty member. Additionally, a multimedia lab is available for faculty, with staff support, to design interactive multimedia programs. The strong commitment of the COE to lead the way in technology has resulted in a rich array of technology resources for faculty and students.

Three Examples of Innovative Technology Initiatives in the COE/VSU

Building Capacity and Providing Support for School Decision Makers in Rural Settings: A Success Building Model

With funding provided by the U.S. Department of Education, Office of Special Education and Rehabilitation Services, Drs. Patti and Bob Campbell from the Department of Special Education and Communication Disorders at Valdosta State University (VSU) are currently conducting a Project of National Significance that addresses two specific needs. First, there is a need to develop effective strategies to maximize the time and energy devoted to planning and delivering necessary inservice training; and, second, a technology rich environment through internet based tools is needed. The purpose of this application is to develop a model Web-supported assessment system and on-demand tutorial modules for collaborative training for regular and special education personnel, including paraprofessionals.

Preparing Tomorrow's Teachers to Use Technology (PT3)

With funding provided by the U.S. Department of Education, Dr Art Recesso from Curriculum and Instructional Technology and Dr. Marti Venn from Special at Valdosta State University are currently conducting a PT3 grant. The primary focus of the project is to enable preservice teachers be more effective infusers of technology. We are training faculty and preservice teachers in the areas of assistive technology, technology integration, video capture and editing, and virtual reality related technologies. PT3 is working very closely with the GSTEP project to deliver training and further expand the development of the Virtual Learning Resource Bank. Details about the project and our efforts to implement other initiatives such as video conferencing and streaming authentic classroom practices video are available at: http://www.teacherresourcebank.com.

Promising Practice: Infusing Assistive Technology Into General and Special Education Classes

Several researchers have advocated that assistive technologies may provide assistance needed to allow teachers to accommodate students with disabilities in the general education curriculum (e.g., Edyburn, 2000, Malouf, 2000). "Rather than viewing technology as an 'add-on', current thinking envisions technology embedded within curriculum and instruction as a tool-an 'accommodation' that is necessary for all students-for meeting curriculum goals" (Pugach, & Warger, 2001, p. 229). However, general education teachers reported that they were not competent in the integration of technology into curriculum content nor were they prepared to meet the needs of students with diverse learning needs (U.S. DOE, 2001). Hence with the funding of the PT3 grant, COE faculty in general education and special education were recruited to participate in professional development activities in order to modify their current syllabus to add in assistive technology knowledge and skills and to design new course activities in which preservice students demonstrated their newly gained assistive technology skills. Preservice students across a variety of coursework in early childhood (K- 5^{th}) and special education (K-12) were administered a survey of knowledge and skills in technology and assistive technology prior to beginning of their course and then at the conclusion of the course. Many interesting findings emerged.

Albany State University Technology and Teacher Education

The College of Education at Albany State University has had an exemplary history of preparing teachers and preparing all teacher education candidates at the cutting edge of technology. As a Historical Black College and University, the University serves a diverse population of students most of which are black. The challenges of the teacher preparation are many. Primarily serving a student population that comes to the University from the rural surrounding areas of Southwest Georgia, the University takes on new and sometimes insurmountable challenges. Regardless of the students' background, the expectations are that the COE graduate a fully certified and competent classroom teacher.

The GSTEP (Georgia Systemic Teacher Education Program) project at Albany State University is a collaborative effort existing with Valdosta State University, and the

University of Georgia designed for the ultimate purpose of developing Education Reform. A GSTEP Framework that rests on a set of fundamental principles that define its intentions and vision supports the project.

They are:

- Learning to teach is a career-long process of growth.
- Each teacher designs his or her or own career path.
- Effective teaching yields evidence of student learning and achievement.
- All students and their teachers deserve high expectations and strong support to achieve their best.
- Technology facilitates teaching, learning, community building, and resource acquisition.
- Positive and productive dispositions, attitudes, and temperament have an important impact on student growth, teacher growth and school climate.
- Multi-layered support and continued professional development involves various participants.

Both pre-service and in-service teachers are using the framework. With the focus on technology, the University has embellished the InTech Framework, PT-3, and the emerging Teacher Recourse Bank.

InTech

Albany State University was one of the first in the University System of Georgia to infuse InTech training and certification into the curriculum at the undergraduate level. Beginning with the graduating class for the fall semester, 2000, all graduates in Education were certified in InTech. InTech is an acronym for INtegrating TECHnology and the Framework is designed to accommodate educators with varying technological skill levels. The spiral scope and sequence of courses will serve the needs of educators as they progress from entry level to proficiency with instructional technologies.

The first students to be InTech trained were certified as a part of their student teaching requirements. Since the University's initial training of students, a core of COE faculty have been trained and certified. The students are now able to receive their certification at the sophomore level when they enroll in the course, Technology and Media for Teachers. This thereby enables each student an opportunity to apply the three I's to clinical, classroom and the Charter School experiences. The Charter School is expected to open in the Fall, 2002. All faculty and students in the COE are expected to model the principles and practices of the InTech Framework.

According to the Georgia Educational Technology Training Centers, the three I's identified below are the foundation for the development of the certification process. The Three I's are defined as INtegration, INfusion, and Innovation.[1]

Initial Phase:

The initial phase, INtegrating TECHnology, is characterized by immersion in a technology-rich professional development environment. Often referenced as "In-Tech", the course is designed to bring entry-level users to a point of general technology competency. This rigorous curriculum immerses the novice in an intense fifty hour course of study designed to build skills and comfortable levels of performance in five critical areas of instructional proficiency: 1.) Quality Core Curriculum Content Standards, 2.) Use of Modern Technologies, 3.) New designs for Teaching and Learning, 4.) Improved Classroom Management, and 5) Enhanced Pedagogical Practices.

Infusion:

This phase of coursework is characterized by Infusion of technologies at the point of instruction with the goal of improved student achievement. The courses are designed for educators that are comfortable using technologies to improve student learning. The courses are presented as a menu of electives from which educators can select topics related to an academic discipline. The Infusion courses are designed to build an educator's content knowledge while advancing technology skills through applied use of technologies for accelerated teaching and learning.

Innovation:

The Innovation phase targets technology proficient educators seeking methods, projects, tools and innovations to enhance and empower student learning through the use of real-world technologies. This dynamic module evolves and changes as learning technologies are refined and as research identifies practices and strategies for improving an accelerating student learning through innovative applications of modern technologies.

PT-3

The second component of technology and teacher preparation involves the support received from the PT-3 Grant. The funding was approved by the U.S. Department of Education under the SOWEGA (Southwest Georgia) Project. The primary purpose of the grant is to prepare Tomorrow's Teachers to use technology. Mini-grants are awarded to faculty members in the COE of Education and Arts and Sciences who teach prospective teachers. Faculty teaching core courses as well as specific courses within the discipline at the undergraduate level are eligible for the mini-grants. Funding may range from $3,000 to $12,000 a year. Grant money may be used to develop on line courses, redesign courses and improve course delivery.[2]

The COE also participates in the Wide Networking Field Experiences Project which is a part of the Ga. P-16 Initiative, ETTC, and various P-12 Partner schools and P-12 school systems.[3] The purpose of this project is to ensure that all Georgia teacher candidates demonstrate proficiency in the use of modern technologies to improve student learning during field experiences and internships and prior to graduation.

Accordingly, the goals of the Wide Networking Field Experience Project are:

1. Improve the quality of Georgia teacher preparation programs by creating P-16 partnerships that share responsibility in the preparation of educators for Georgia Schools.
2. Improve the ability of future teachers to use technology in improving teaching practices and student learning opportunities.

Albany's Plans for the Teacher Resource Bank

The newest and perhaps the most exciting component of technology for teachers at the University will be the Teacher Resource Bank. It is expected that the Teacher Resource Bank (TRB) will be developed as a part of the GSTEP Initiative as a collaborative effort with Valdosta State University, and the University of Georgia. Albany State's vision of the Teacher Resource Bank which is currently being established and defined will be a repository of resources (references, data, portfolio's of best practices, bad practices, etc.) providing support for the beginning and pre-service teachers.

The mission of the University includes serving as a resource for all teachers in Southwest Georgia. Consequently, the TRS will be comprehensive and will serve as a tremendous support system for pre-service and beginning teachers in the area. Within the

TRB will be a wealth of tools and materials that will help the teachers and aspiring teachers within the classroom.

The GSTEP partners aspire to make the TRB a household name in the education arena in Georgia and in the nation. It is intended to become a standard reference tool and a means to ensuring quality training for both in-service and beginning teachers.

Local Illustration

One campus initiated several efforts at systematic collection and use of data during the 01-02 academic year in GSTEP involvement. These efforts might be considered illustrative of specific attempts to 'pilot' the actual interface between teacher induction as a comprehensive process and technology integration as a guiding premise of this particular Georgia campus.

The actual results presented below should be considered 'preliminary' as the information collected and analyzed were part of the larger GSTEP sequencing as a full five year project in teacher induction. This means that this report of the second or 'piloting' year was done with an evaluative eye toward what would be capable of full implementation as 'benchmark' evaluation in years three and four of the project. It was also assumed that much of the latter years will be devoted to 'going to scale' as a translation of what has been field tested at Valdosta State, Albany State and University of Georgia and now implemented to a larger audience throughout the state.

GSTEP emphases this second or 'pilot' year was built upon the initial 'formative' year or establishing the intellectual integrity of the Teacher Resource Framework so that each of the three campuses have a common and agreed upon language about Principles and Elements of teacher induction. In addition there has been a concurrent inquiry about the role technology plays within the various Elements and how it helps in describing a threshold of 'exemplary' teacher behavior and disposition.

Focus group evaluative efforts conducted on all three campuses have solicited a spectrum of opinion, ranging from discounting technology as a 'mere tool' or 'machines' (sitting idly in the back of classrooms), through an urgent, felt need for 'something' still new and mysterious to Georgia P-12 practice and on to a strong and sustained advocacy for fully integrate technology in all instructional strategy and Georgia teaching preparation in the 21st Century.

While GSTEP struggled to make sense of such a varied data base, what was becoming clear was that more detailed information than what simple focus group perceptions could provide was needed. Such information on the technology prone 'local' campus allowed 'proof of concept' inquiry about;

(a) perceptions of graduating seniors about their teacher preparation program and whether technology integration was seen as a strongly embedded institutional value,
(b) the perceived "usability" of advanced technology techniques (specifically, the HTML (Hypertext Markup Language) and VRML (Virtual Reality Modeling Language) versions of the Teacher Resource Bank by both student teachers and newly hired teachers in the field, and
(c) the self-assessment of select college of education students 'knowing' about technology standards and 'assistive' technology applications as an integral part of their curriculum and instruction in special education and early years teacher preparation.

Perceptions of graduating seniors about their teacher preparation program

In Fall 2001 a copyrighted survey from Educational Benchmarking, Incorporated (hereafter EBI) was given to all graduating seniors in one college of education. These students responded to seventy two items covering many subjects of their actual preparation process within the College of Education and also about their student teaching experiences in the field. Three questions related to 'technology' were whether coursework emphasized 'the impact of technology on schools," whether classes emphasized 'the use of multimedia technology' and whether the graduating seniors felt they had been 'trained to use the College computing resources.' The local college of education GSTEP partner compared how a select sample of twenty four (n=24) graduating students responded to these three EBI items and how these same students felt about premises of technology application within broader statements of what it takes to be an 'exemplary' teacher according to GSTEP. The results exhibited a strong and positive correlative relationship between each of the three EBI responses and focus group expressions of need for technology integration in discussing GSTEP elements of Knowledge of Students and Their Learning (II-H), Learning Environments (III-H), Planning & Instruction (IV-E) and Assessment (V-G).

During next or the third benchmark evaluation year of the five year project these fledgling pilot test results will be the primary rationale for a more extensive effort at concurrency validation of EBI survey items and GSTEP Elements relationships. It is planned that student teachers will participate in data collection both the Fall and Spring semesters of Academic Year 2002-2003. Specific analytical comparison will use the initial Fall 2001 group perceptions as a point of comparative departure.

The perceived "usability" of advanced technology techniques

A second area of 'pilot' data assessment involved both the general electronic features of the Teacher Resource Bank and a special sub-part of the Bank developed using Virtual Reality Modeling Language (hereafter VRML). During the Spring 2002 semester the college of education GSTEP partner provided specific familiarization training for eighty two (n=82) 'newly hired' public school teachers from two local districts (one city and one county jurisdiction). These new hires were approximately one half teachers in their first permanent job and one half more experienced teachers. Part of the training for a selected sample (n=25) was a 'proof of concept about usability' assessment which documented new hire teacher responses to the VRML experience. The participants were given a full hour of hands-on access to the VRML. Minimal directions for VRML use were given as the primary question being explored was whether untrained, essentially novice users could manipulate their way through the virtual field and actually use the advanced technology setup.

A general survey about ease of developing initial understandings and then actual use of VRML was administered to all participants. The survey, initially created by Brooke (2001) describes perceptions of technology use. A follow-up interview with five first full-time job teachers who had prepared at the GSTEP partner's college of education added specific contextual embedding of perceptions about technology use.

Results from the survey and follow up interview impression gave strong and statistically significant estimates of VRML usability by 'novices' or educators with no special technology training. For the expectations of second year 'piloting' these results were a form of validation that the college of education's 'sunk costs' in promoting advanced technology and commitment to the premise of technology integration throughout teacher induction were justified. As few folks can adequately estimate the knowledge of technology users prior to being exposed to advanced technology (especially through electronic access to the Bank site) the benchmark for 'acceptable' use is the expected lowest common denominator.

Public school teachers working in two south Georgia counties, especially some of the more experienced but 'newly hired,' created an honest acid test for perceiving what was 'useful' and 'easy to use.' The VRML version of the Teacher Resource Bank passed both criteria with flying colors. Were these a special 'hand picked' group of users whose perceptions of easy use can not be generalized? That is the hypothesis framed for systematic appraisal during year three of the GSTEP project.

Teacher Preparation Department students 'knowing' about technology standards and 'assistive' technology

The third data collection and analysis occurring during Academic Year 01-02 focused upon students in both the special education and the early education departments of the GSTEP partner's College of Education. In this case undergraduate teachers in sophomore, junior and senior years in both curriculums were surveyed for their perceptions of 'knowing' about International Society for Technology in Education (ISTE) and Council for Exceptional Children (CEC) Standards promoting general technology integration and special education features of 'assistive' technology that can facilitate disabled students by modifying regular instructional practice (Recesso, Venn, and Wiles 2001). The Georgia Professional Standards Commission adopted these standards in 2001. In addition, a master's level graduate class in special education training was administered the same survey.

The research inquiry was whether the more time spent in undergraduate and graduate teacher preparation contributed to a sense of more 'knowledgeable' about technology standards and 'assistive' applications. Specifically, did seniors feel more knowing than juniors or sophomores?

A second research question was whether special education majors were inclined to believe they were more knowing about technology expectations than elementary or early years education majors from the same College of Education. Given the strong campus-wide and college emphasis on having an 'enriched technology environment' and several required courses in using computers and other technology, it was plausible to suggest no difference. The real advantage of special educators knowing about 'assistive' technology for disabled seems a more likely difference between the two majors.

Survey results for this year lead to no strong patterns of relationship or particular differences. There was a general pattern supporting the idea that seniors 'knew' more about technology standards than earlier undergraduate years, (and graduate students even more)but the differences were item specific and only statistically significant in a few instances. While special educators were more comfortable with knowing about the use of 'assistive' technology than elementary educators there were almost equal understanding of ISTE and CEC standards.

Methods

Participants

The participants were enrolled in undergraduate and graduate College of Education courses taught by faculty from the department of Special Education and Communication Disorders. The survey was provided to students in Spring of 2001 by the faculty member assigned to teach the course. A total of 4 undergraduate courses and one graduate course were identified as sites for administering the survey on instructional and assistive technology. The groupings of students were selected to serve as initial benchmarks at which progress could be measured over time (3 years).

Undergraduate College of Education preservice educators. Students in two preservice sections of Serving Students with Diverse Needs were selected to respond to the survey. This course is required of all students enrolled in the College of Education in the state of Georgia and must be taken prior to entering their teacher preparation track (e.g., middle and secondary, early childhood education, special education, physical education). A total of 77 preservice College of Education core students participated in this survey.

Undergraduate preservice special educators. Two groups of preservice special education students were surveyed. A preservice course in the junior core for students majoring in a dual certification program (early childhood education and interrelated special education and a senior level methods/materials for students with mild disabilities were identified as sites for administering the survey regarding student perceptions regarding instructional and assistive technology during preparatory course work There were nine students in the dual certification program and 24 students in the senior methods course for serving students with mild disabilities.

Graduate preservice special educators. A graduate level course in collaborative roles in education was selected to administer the survey. We identified this cohort because it was the first cohort of students of a new three-year program that culminates in a masters degree in special education in mild disabilities. This group of students had the required computer course in the education core and then a technology course as a senior and in their graduate program.

Technology Required Courses

All College of Education students in their core (freshman/sophomore) years must take ACED 2400. This course is designed to provide hands-on experience with computer applications such as word processing, databases, spreadsheets, communication and presentation software.

For preservice students in special education they take a technology course in their senior year and their 5th year (graduate level). The undergraduate course is designed to assist students in the uses of computer hardware and software as they relate to the individualized program and needs of the student. At the graduate level, the students apply associated computer hardware and software as they relate to the needs of students with disabilities in K-12 classrooms where they are student teaching.

For preservice students enrolled in the dual certification program in early childhood and special education, they take a technology course during their junior year. This course explores the integration and application of technology into the early childhood curriculum. The technology course is taught by faculty in the Department of Early Childhood. In order to address a critical goal of our "Preparing Tomorrow's Teachers to Use Technology" (PT3) a pilot section of this course was added to the curriculum. Faculty in the Educational Technology Training Center and faculty in Special Education modified the existing content to infuse assistive technology knowledge and skills into the course.

Pilot Technology Course

The students in the dual certification program were also enrolled in a pilot section of ECED 3000- Integrating Technology into the Early Childhood Curriculum (3 semester hours). These students were selected to pilot a new course format that infused assistive technology into their already existing ECED 3000 course. In this section, 2 preservice students were paired with a faculty member in either early childhood education or special education and a regular education teacher in P-3rd grade. The faculty member on the team served as a resource however they were considered "new learners of technology" while the regular education teacher was completing a State of Georgia inservice requirement for certification in integrating technology. Hence, all 4 participants (students, faculty, and teachers) were learning to integrate technology and assistive technology into their coursework and/or lesson plans. The preservice students and the regular education teachers were required to design and implement four to six technology-connected lesson plans. The preservice students were additionally required to address modifications and accommodations for students with disabilities within their lesson plan At the conclusion of the course (8 days) and the submission of all lesson plans, the preservice students received a letter grade and a certificate stating they had met the State of Georgia technology requirement.

The framework for INtegrating TECHnology (Georgia Educational Technology Training Centers, 2000) is a highly structured 50 hour, Georgia Professional Development Program. The training utilized was designed using the topical backdrop of the rain forest. Members of each team participated in individual technology focused learning activities surrounding software (e.g., Inspiration, Kidspiration, Graph Club, etc) as well as partnering and whole team activities experimenting with assistive technology hardware (e.g., joy sticks, switches, Intellitools) and specialized software (e.g Boardmaker).

Instrumentation

A 24 item survey was designed to assess preservice and graduate students perceptions regarding their current knowledge and understanding of computer technology as it relates to enhancing learning of K-12 students with and without disabilities. Sixteen computer technology competencies were identified from the ISTE general preparation performance profile for preservice technology proficiency. Eight assistive technology competencies were identified and selected for the survey, but we will focus on the 'standard' technology items in this article.

Respondents were asked to respond to statements in the following manner: (1) " I'm clueless, I have never heard of it in any of my classes; (2) "Rings a bell, I may have heard about it in a class"; (3) I can name it, I definitely remember hearing about it in a class"; and (4) "This is my final answer, I remember this information and can share it with others". This scale was designed to gather information on whether students perceived that they had been exposed to and/or had acquired this content within their program of study to date and not to validate their actual knowledge or skills in instructional and assistive technology.

Research Expectations

Use of perceptual data collection was intended to accomplish two objectives. First was an item by item analysis of responses to the sixteen ISTE standards. The

National Educational Technology Standards (NETS) project had determined each of the sixteen were equally 'fundamental' in their value as standards of expected 'technology knowing' but what would the students perceive as their sense of 'knowing?" Would some items be perceived in a greater 'knowing' than others and, if so, could a statistical threshold be utilized to identify ISTE standards less clear? The research problem was to see which items students patterned as distinctly 'did not know,' which items students said clearly, 'I know that,' and those items where there was no systematic direction toward knowing or not knowing.

The actual format for research was all students responding to the each of the sixteen items composing the survey. The last four digits of the student ID allowed the relationship of survey results to specific students. The response format was a four option, forced choice arrangement ranging from 'I am clueless' to 'I am certain.' For analytical purposes, and to insure the most conservative test of systematic patterning, the four option response was collapsed to a binary distinction of 'knows' or 'doesn't know' judgments.

Chi Square analysis of expected frequencies using chance allocation alone compared observed frequencies of survey response for all students. Differences found at the .05 level of significance or greater probability of systematic patterning were considered directional and indicative of a clear preference for knowing or not knowing. Items found with less than the.05 level of significance were assess as mixed or unclear as a statement of student perception.

The second objective was to determine the cohesiveness of the student results as an entire population. Items determined to have statistically significant directionally in the initial study above were reanalyzed by Chi Square, but this time differentiating the binary of 2X2 choice per item to subdivision of five sections in four grade levels (5X2). Follow up Crosstab presentation of item allowed the actual distribution of responses contributing to a systematic pattern of difference to be noted in percentages.

Response to the ITSE Standards

Eleven of the sixteen standards were found to have a pattern of systematic response where the students exhibited a perception of knowing or not knowing. The six items that did not achieve a statistically significant relationship to student perceptions, are noted in Table 1.

Table 1

Item	**Name**	**Probability**
3	Name common input and output devices	NS
7	Ways to use tech resources to facilitate higher order and complex thinking skills	NS
12	Ways to use a variety of media format, including telecommunications, to collaborate, publish and interact with students, peers, and experts	NS
13	Ways to evaluate new technologies	NS
14	Ways standard technology solutions can be used to enhance learning and performance in K-12 classrooms include	NS
15	Ways to integrate the use of standard technology solutions to enhance the participation and achievement of students in K-12 classrooms include	NS

We can speculate why these particular items gained mixed response. The survey items reflected the language of the NETS standards. Although the intent of the standards is to measure preservice student technology competencies, the wording of the standards may not be discriminatory enough for a likert response or may not be measurable. On the other hand students may not have interpreted the question due to jargon or courses not delivering the content. Regardless, the technology competencies could not be interpreted as a cohesive packet of standards.

Eleven items were determined to have a pattern of statistically significant student responses. Table 2 presents the item, the chi square value determined from a 5X2 comparison and the probability threshold established at $p<.05$ confidence minimum.

Table 2

Item # Name	Pattern of Directionality	Chi Square	Probability
1. Understanding of the nature and operation of technology systems.	knowing tech	4.5	.03
2. Name common input and output devices.	knowing tech	7.0	.008
4. Ways to use standard technology tools and information resources for creating lessons.	knowing tech	21.4	.0001
5. Ways to use standard technology tools and information resources for student learning.	knowing tech	22.7	.0001
6. Ways to use content-specific technology tools.	knowing tech	8.0	.005
8. Ways to use technology to locate, evaluate, and collect information from a variety of resources.	knowing tech	28.1	.0001
9. Ways to use technology tools to process data and report results.	knowing tech	31.2	.0001
10. Ways to use standard technology for solving problems.	knowing tech	13.7	.0001
11. Ways to use standard technology tools for communicating.	knowing tech	47.5	.0001
13. Ways to evaluate new technologies.	don't know tech	21.1	.0001
16. Resources and support for obtaining information about standard technology solutions include .	don't know tech	4.6	.03

Table 3 presents the most distinctive and pronounced pattern of 'knowing technology' was evident in item 11, then 8, then 9. It was least pronounced in item 1. Item 11 asked to what extent preservice teachers know of ways to use technology tools for communicating. Every student is given a university email account, all course registration is online, all college of education students are required to create an E-portfolio, and there is widespread use of email, listservs, and webpages by faculty. These skill and knowledge building opportunities can be attributed to 80.5% of all respondents knowing of ways to use technology for communicating.

Item 8 asked to what extent preservice teachers know of ways to use technology to locate, evaluate, and collect information from a variety of resources. 73.4% of all respondents reported having acquired this knowledge in courses. The introductory computer course and methods courses provided evidence of students being taught to use Internet search engines, campus library online catalog searches, and the statewide Georgia Library Learning Online (GALILEO) system to retrieve articles and other print materials.

Item 9 asked to what extent preservice teachers know of ways to use technology tools to process data and report results. The ACED 2400 course provides students with strong foundation in the functions of word processing, spreadsheet, and database software packages. Furthermore, the InTech training gives students experience applying knowledge of the office suite software by infusing the technology into lesson plans and learning activities. 74.8% of all the respondents knew how to use the technology.

Although item 1 showed a pattern of directionality towards knowing, compared to all other items the responses varied the least from expected or chance. 59.5% students said they had an understanding of the nature and operation of technology systems. The lack of variance may be attributed to the standard not being measurable and, therefore, there is very little discrimination between knowing and not knowing. Using Gagne, Briggs, and Wager (1992) we argue that 'understanding' is not an adequate verb to write a measurable standard. A more appropriate term may be list, define, or even describe. Furthermore, the term 'technology systems' may be so nebulous as to have different, or no meaning to each student. If the term were replaced by terms such as operating system, local area network, or some other specific example of a technology system, respondents would be able to succinctly determine if it were a part of their knowledgebase.

Items 13 and 16 reported the highest percentages of don't know responses across groups. Item 13 asked if the preservice teachers knew of ways to evaluate new technologies. A majority of sophomores, seniors, and graduates did not know how to evaluate new technologies as compared to a third of the juniors (See Tables 2 and3). Item 16 asked preservice teachers if they had knowledge of resources and support for obtaining information about standard technology solutions. The majority of sophomores, seniors, and graduates did not know about these resources. This is in comparison to under 29% of juniors.

Looking at items 11, 8, and 9 the most evident distinction is the unanimous opinion of the Juniors that these technology standards were well known to them. The second indication of internal patterning is that Soph B seemed more assured on items 9 and 8 than Soph A but the two pre-education major groups were virtually the same on item 11.

The progression towards graduation parallels progress towards technology competency by class. The exception is the special treatment group junior class. This is evident in each of the items in Table 3. Even the items 13 and 16 describing the students in general as having a pattern toward 'not knowing', show the majority of treatment group juniors as having knowledge of the technology competency.

Table 3 ITEM NO.	CLASS	% DON'T KNOW	% KNOW
1	Soph A	46.5	*53.5*
	Soph B	34.3	*65.7*
	Junior	12.5	***87.5***
	Senior	45.8	*54.2*
	Graduate	43.8	*56.3*
8	Soph A	30.2	*69.8*
	Soph B	40	*60*
	Junior	0	***100***
	Senior	25	*75*
	Graduate	5.9	*94.1*
9	Soph A	16.3	*83.7*
	Soph B	38.2	*61.8*
	Junior	0	***100***
	Senior	41.7	*58.3*
	Graduate	11.8	*88.2*
11	Soph A	23.3	*76.7*
	Soph B	28.6	*71.4*
	Junior	0	***100***
	Senior	16.7	*83.3*
	Graduate	5.9	*94.1*
13	Soph A	*74.4*	25.6
	Soph B	*71.4*	28.6
	Junior	*33.3*	**66.7**
	Senior	*62.5*	37.5
	Graduate	***88.2***	11.8
16	Soph A	*67.4*	32.6
	Soph B	*50*	50
	Junior	*28.6*	**71.4**
	Senior	*65.2*	34.8
	Graduate	*64.7*	35.3

Discussion

A much needed effort to define technology standards for preservice students before exiting colleges of education and entering school systems has been completed. As indicated in the analysis section some of the standards statements are problematic in that they do not by more than chance differentiate between students knowing or not knowing if they have acquired the knowledge and skills to meet the standard. Therefore we recommend, as is often done with standards and assessment work, a review of the wording of some standard statements to ensure they are in fact measurable and discriminate enough to differentiate between preservice students having or not having acquired the knowledge to meet the standards.

The majority of standards statements were valuable in an effort to delineate a progression of preservice student technology knowledge parallels their evolution towards graduation except in the case of students receiving special technology training. At issue is the student progression of computer related technology knowledge and skills only meet a level of awareness and not the ability to generalize their knowledge. To apply their knowledge in new settings, with new students, and different topics they must learn technology integration at a higher level.

Even though the preservice program we studied is making technology available to students, requires all students take an introductory course on computer technology, and has infused technology into some courses, the preservice students still do not reach a target level of being able to infuse technology into a variety of settings and situations. Colleges of education that may be meeting the needs of student in terms of capacity to teach about technology, offer the resources for students to learn and use technology, and even bring their student to a level of awareness, are accomplishing something that many other schools are not. But it is still not enough. All colleges of education must working towards infusing technology further into methods and a variety of other courses. Technology should not be an add-on, maybe not even a separate course. Computer related technology should be used as a tool for problem solving, presentation, inquiry, discovery, or simulation of applied knowledge in all courses.

Only when we reach a critical mass of computer-related technology being used in meaningful ways in all courses will preservice students evolve into inservice teachers as users and infusers of technology. But it will take a critical mass of savvy faculty who "know" the technology, its appropriate applications, and ways to infuse it with their content and pedagogy. This is one of the more serious roadblocks because very often technology knowledge has no bearing on tenure or promotion and often does not offer other rewards. The rigors of publication, presenting, and departmental details preclude faculty from taking the time to learn the technology well enough to teach the students. Our argument is that compute related technology as a tool for teaching and learning is as important as any other tool used to support content and pedagogy. Teachers learn the utilization of a variety of tools for teaching and learning in their preservice preparation programs. Therefore, it is imperative the colleges of education preparing our future teachers take seriously the task of having an adequately trained faculty, provide access to computer related technology, and purport technology knowledge and usage as important.

We are proposing an initial step towards preparing teachers to effectively infuse and utilize technology for teaching and learning. The GSTEP Teacher Resource Framework is a 'living document' reflecting, in part, teacher knowledge related to technology (See Figures 3).[4] Additional efforts will involve piloting and implementing these elements and indicators to understand to what extent preservice and inservice teachers are able to demonstrate progression towards the target expectations.

Figure 3. DRAFT GSTEP Teacher Resource Framework Elements and Standards Related to Technology

ELEMENT	INDICATOR
Content and Curriculum	• Exemplary teachers us technology (for example, computers, internet, media, calculators) in their work in the discipline. a) teachers use technology to support their learning about the discipline, b) teachers use technology to do work in the field(s) as a scholar, employee, or consumer, and c) teachers observe, experience, and practice the use of content-specific tools to support learning and research in their major field(s) of study. • Exemplary teachers display dispositions (attitudes, outlooks, temperament) of an active, engaged learner in their field(s), including; enthusiasm for the uses of technology that support lifelong learning, collaboration, personal pursuits, and productivity in their field(s).
Knowledge of Students and their Learning	• Exemplary teachers are concerned about all aspects of a child's well being; access to and use of resources, including technology. • Exemplary teachers are fully informed about and adapt their work based on their students' areas of exceptional learning; teachers utilize assistive technology to meet the needs of disabled and other students. • Exemplary teachers know how to use technology effectively to support students and their learning.
Learning Environments	• Exemplary teachers create student-centered learning environments that encourage and promote; student identification, location, and use of learning resources, including technology. • Exemplary teachers use technology to provide, extend, and enhance the learning environment. 1) teachers use the Internet, learning systems, and a variety of software to provide learning environments that engage the student interactively, 2) teachers use web pages, software, and hardware to enhance the existing learning environment.
Planning and Instruction	• Exemplary teachers articulate clear and defensible rationales for their instructional choices. a) teachers use data from content and curriculum, students, the learning environment, assessment, technology and other resources, and their profession to explain their choices and decisions in instructional planning. • Exemplary teachers us technology to manage, enhance, and individualize instruction for diverse learners through learner-centered strategies. 1) teachers use technology to support collaborative activities, 2) teacher use effective and efficient technology-based management and communication tools, 3) teachers facilitate technology-enhanced instruction, addressing both content and technology standards, 4) teachers utilize technology resources to teach higher order and complex thinking skills, 5) teacher use and manage telecommunication and information technologies as resources and tools for learning, and 6) teachers operate technology systems efficiently and effectively in everyday practice. • Exemplary teachers use knowledge and effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom; teachers value many ways in which people seek to communicate and encourages many modes of communication in the classroom; they support and expand student expression in speaking, writing, technology, and other media.
Assessment	• Exemplary teachers choose and develop classroom-based assessment methods appropriate for instructional decisions, link assessment, directly to targets (or goals, standards, or objectives) and integrate these assessments into short and long-term planning; technology is used as an assessment tool. • Exemplary teachers involve students and families in their assessment; teachers engage students in adaptive uses of technology to demonstrate their own growth.

	• Exemplary teachers keep accurate and up-to-date records of students' work, behavior, and accomplishments; teachers use available technology as an assessment tool for record-keeping and data analysis.
Professionalism	• Teachers use technology resources to conduct the work of the school; teachers use technology to collect, analyze, interpret, and communicate school improvement data to improve instruction. • Exemplary teachers design their own career paths as professional educators; teachers seek continual growth in technology knowledge and skill; they evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning, use technology to increase productivity, use technology resources to engage in on-going professional development and lifelong learning.

Policy implications for GSTEP in its third 'benchmarking' year

The GSTEP project on the local campus engaged in three major data collection efforts to try and 'pilot' some appreciation of what 'technology integration' might mean for on-going teacher induction efforts. We do feel the general appraisal given by Educational Benchmarking Incorporated does provide a basis for establishing a concurrent validation process with the GSTEP Resource Framework document in places that concern technology application. During 2002-2003 school year we intend to compare and contrast this year's Fall 2001 data results with two cohorts of graduating student teachers.

The continued use of the electronic Teacher Resource Bank necessitates an established evaluation format. What year 2001-2002 verified was that even the most advanced feature of the Bank, the VRML classroom, could be easily access and successfully used by 'novice' audiences. Now comes the hard part of placing various Principles and Elements of GSTEP in appropriate electronic formats and systematically appraising the use patterns during 2002-2003. The feeling of students in the on-going teacher preparation program that they 'know' about nationally developed technology standards and specific applications of 'assistive' technology needs an inter-campus comparison before policy implications can be drawn.

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[3] Georgia State Data and Research Center, 2001

[4] Only the DRAFT technology-related statements are included here. There are principles, 6 elements, and numerous indicators that are not detailed in this paper.

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