METHODS USED TO DETERMINE TECHNOLOGY COMPETENCE FOR VIRGINIA TEACHERS

by

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Abstract

By July 1, 2003, all Virginia public school teachers must demonstrate proficiency on technology standards mandated by the Virginia Department of Education (VDOE). The responsibility for verifying each teacher's level of proficiency was delegated to the local school divisions. Public schools across the Commonwealth of Virginia were not given specific direction on how to provide staff development or assess instructional personnel in technology skills except to suggest different web sites on the Department of Education's home page. The Virginia Department of Education commissioned a study to assess the availability and use of technology in Virginia's public schools (Virginia Department of Education, 1998a). Recommendations from the study suggest that Virginia should maintain high proficiency standards for teachers and administrators and should consider statewide prototypes, although no prototypes have been recommended by the VDOE. The purpose of this study is to describe and analyze the various methods utilized to assess instructional personnel across the Commonwealth of Virginia on technology standards. A survey was distributed electronically to the directors of technology in each school division in the Commonwealth of Virginia. Methods of assessing instructional personnel, perceptions of effectiveness and cost effectiveness of each method, incentives to meet demonstrated proficiency on the technology standards, and percentage of teachers meeting demonstrated proficiency on the technology standards were assessed on the survey instrument. A 79% response rate indicated that workshops, college courses and portfolio assessment were the methods most used in Virginia public schools. The most effective methods were reported to be workshops, mentoring, performance assessment and college courses. The most cost efficient methods were reported to

be portfolio, and signed demonstrative proficiency statement. Recertification points and certificates were the most frequent incentives given to those who demonstrated proficiency of the technology standards. Sixty-nine school divisions reported 80 to 100% of their instructional personnel have demonstrated proficiency on the technology standards as of June 2002.

Dedication

I dedicate this paper to the three men in my life: my father, Joseph C. Scaparra, and my two sons, Austin and Travis Hayes, whose love and support I had throughout my study. I also dedicate this paper to my mother, Mary Helen Scaparra, posthumously. I know she knows.

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CHAPTER I

OVERVIEW OF THE STUDY

The Importance of Technology in Our Society

The effective utilization of technology is critical in our society today. The advantages are numerous for those with technological skills. From the homemaker to the automobile mechanic to the nuclear engineer, technology is embedded in the workplace and the home environment. Knowing how to use and access technology empowers people. Industry is saturated with technology and businesses cannot function without it. These facts make it critical that educators integrate technology instruction throughout all disciplines. “The use of technology, integrated across the curriculum, will provide numerous opportunities for students’ use of existing and emerging technology tools for communication, productivity, management, research, problem solving, and decision making” (DeMary, 2000).

The Technology for All Americans Project (ITEA, 1996) appeals to policy makers, educators and all Americans to ensure technology literacy for all Americans. The International Technology Education Association stresses the importance of having every student study technology. “Technological literacy is much more than just knowledge about computers and their application…it is a subject vital to human welfare and the economic prosperity” (p.1). Understanding the breadth of possibilities technology affords us is to understand one can develop products, design, improve ways to communicate, build structures, and solve problems (ITEA, 1996). In essence, no one knows the extent to which technology will takes us in the future, but the power is there, and those who are not technologically literate will be at a major disadvantage.

National Standards for Students

The United States Department of Education leaders believe that technology is one tool that should be used to improve student achievement. In order to support school divisions across the country, grant programs and E-rate funds are allocated to states by formula to ensure that technology funds reach the classroom. All 50 states are recipients of this funding. Funds may be used for software purchases and development, wiring and technology infrastructure, and teacher training in the use of technology (United States Department of Education, January 29, 2001). In turn, the states require school divisions to submit technology plans that support the national educational technology standards.

National educational technology standards for students, preK-12 are in place. They cover six broad areas: (1) basic operations and concepts; (2) social, ethical and human issues; (3) technology productivity tools; (4) technology communications tools; (5) technology research tools; and (6) technology problem-solving and decision-making tools (International Society for Technology in Education [ISTE], 1998). Although states across the nation are designing assessment instruments to assess student performance on these technology standards, only four states currently assess students on technology standards; those states are Florida, North Carolina, Pennsylvania, and Virginia (Meyer, 2001). In order to assist students in meeting these standards, schools first must have competent instructional staff who meet or exceed the same technology proficiency that school officials expect of students.. How do teachers rate in Virginia? According to The Report to the Commonwealth of Virginia (1998a), most teachers are not aware of the state's technology plan for schools; furthermore, they do not know how to transfer the state's vision for technology into the classroom. "Only one in five teachers rated themselves as 'advanced' in using computers for instructional applications" (Virginia Department of

Education, 1998a, p.7). This report also indicated that students' ambition to use technology correlated to the teacher's ability to use technology, the support of building resources, and division leadership (1998a). The Report to the Commonwealth of Virginia (1998a) recommends the following:

> (a) Maintaining high standards for technology competencies for pre-service teachers and administrators and the means to achieve such standards; (b) maintaining high standards for technology competencies for practicing teachers and administrators; and creating state support systems for their professional growth that directly link to improved student learning (learning technology centers, professional development models, statewide prototypes); (c) systematically updating, funding, implementing and assessing the state's Six-Year Technology Plan. Parallel school-division technology planning should be supported as a requirement to access state technology funds; (d) supporting statewide purchasing of hardware, software and online services to aggregate buying power and ensure that all schools have access to content through state-provisioned infrastructure. (p. 8)

School boards need to employ teachers who are proficient in technology. The National Center for Education Statistics (NCES, 2000) commissioned a survey in the spring of 1999 on teachers' perceptions of their own preparedness to use educational technology. This survey targeted the nation's public elementary and secondary schools. Although 99 % of the teachers responding reported that they had access to computers in their school, only 39 % reported that they use computers or the Internet "a lot" to create instructional materials and only 34 % reported using computers "a lot" for administrative record keeping. Also, teachers with nine or fewer years of experience were more likely to create instructional materials with the use of computers

(47 %) than teachers with 20 or more years (35 %). The same pattern exists when examining electronic communication among colleagues. For example, teachers with nine or fewer years were 30 % more likely to use email to communicate with colleagues than teachers with 20 years or more (only 19 %). There was a significant positive correlation (at the .05 level) between teachers with more hours of professional development in the use of computers assigning students class work using computers than teachers with less hours of professional development. Teachers with more than 32 hours of professional development in the use of computers or the Internet were more likely to report feeling very well prepared to use computers and the Internet for classroom instruction than those teachers with 0 to 32 hours of professional development in the use of computers (29 % versus 10 %). These statistics support the need for mandated technology standards among teachers. Some states, such as Iowa and Alabama, do not have state mandated technology standards for teacher licensure; they expect college teacher preparation programs to train teachers. Other states require their public school divisions to assess teacher competency of mandated technology standards (NCES).

Technology Standards for Instructional Personnel in Virginia

In order to renew their teaching license, instructional personnel across the Commonwealth of Virginia must demonstrate proficiency on eight technology standards as mandated by the state Department of Education through §22.1-16 of the *Code of Virginia* ([see Appendix A] Virginia Department of Education [VDOE], 1998b). Virginia school divisions were required by the Virginia Department of Education to outline the implementation of these standards in their technology plan for personnel meeting the proficiency standards and to submit the plan to the Department of Education by December 30, 1998. School division superintendents had to ensure that all currently employed instructional personnel were proficient in these eight standards by the end of the school year 2002-2003. Newly hired instructional staff must meet proficiency within three years of initial employment. Currently, teachers employed without a master's degree may take college credit course work in technology in order to satisfy the content requirement for licensure renewal for license holders. Currently, teachers employed with a master's degree may take courses offered at the school division level to satisfy the content requirement for licensure renewal. Virginia colleges and universities must incorporate the technology standards in their approved plan of study for potential teachers.

When one compares the Virginia technology standards for instructional personnel to the standards affecting students, one finds similar standards. The difference lies in the identification of essential skills for each student standard. For example, the VDOE identifies the standards that students by the end of grade 12 are expected to master (Appendix B). Each skill has an explanation associated with the student standard. In contrast, the VDOE lists the standards for instructional personnel but offers no explanation of skills needed for that standard; thus the standards are open to local interpretation.

Statement of the Problem

School divisions across the Commonwealth of Virginia were not given specific direction on how to provide staff development or assess demonstrated proficiency of technology skills for instructional personnel except to suggest different web sites on the VDOE home page. "While the state has adopted teacher standards for technology, assessment is left to individual school divisions and varies widely across those divisions"(Virginia Department of Education, 1998a, p.1). Recommendations from the report to the Commonwealth of Virginia suggest that Virginia should maintain high proficiency standards for teachers and administrators and should consider statewide prototypes although no prototypes have been recommended by the VDOE. It is interesting to note that "demonstrated proficiency" of technology standards is defined as "a demonstrated level of competence of the technology standards as determined by school administrators" (Technology Standards for Instructional Personnel [see Appendix A] Virginia Department of Education, 1998b, p. 1). Therefore, there have been no statewide standards of assessment, no guidance toward designing these assessments, and no systematic measurement of proficiency provided by the VDOE.

There is no standardized assessment to measure technology proficiency, yet demonstrated proficiency is required for teacher licensure by June 2003. At a minimum there is inconsistent requirement for meeting proficiency, and at the worst there is potential for litigation from teachers who may be denied continued licensure. For example, if one Virginia school division measures technology proficiency by one method of assessment and another Virginia school division measures technology proficiency by a different method, one could argue that one method of meeting demonstrated proficiency is more difficult than another method or that the administrator requires a higher standard at one school division than another school division. Also, if significant numbers are denied continued licensure, the statewide teacher shortage problem will only be exacerbated.

Purpose of the Study

The purpose of this study was to describe and analyze the various methods utilized to assess technology standards of public school K-12 instructional personnel across the Commonwealth of Virginia. Currently, according to the Report to the Commonwealth, there is no standard way that school divisions assess instructional personnel or provide staff development in order to meet the technology standards. This study contributed to the body of knowledge of how instructional personnel are demonstrating proficiency on the technology standards across the Commonwealth of Virginia and drew inferences about the perceived efficacy of the methods utilized based upon the collection of these data. This study identified incentives, if any, that school divisions in Virginia offered to instructional personnel in order to meet demonstrated proficiency on the technology standards. Additionally, directors of technology from school divisions across the Commonwealth of Virginia reported the percentage of teachers who have met the technology standards as of June 30, 2002. The results of this study will be shared with the Assistant Superintendent of Technology in the Commonwealth of Virginia and may affect future policy on the assessment of technology standards for instructional personnel.

Research Questions

The following research questions were aligned with the conceptual model and the survey instrument.

1. What methods were school divisions in Virginia using to determine demonstrated proficiency on the technology licensure standards for teachers?
2. How effective was each method as perceived by the division's technology director?
3. Was the method cost efficient as perceived by the division's technology director?
4. What incentives were school divisions in Virginia offering to instructional personnel in order to meet demonstrated proficiency on the technology standards?
5. What was the percentage of teachers who met the technology standards as of June 30, 2002?

Conceptual Model of Study

It is anticipated that this study reflected a wide range of methodologies for assessing teachers. Survey questions pertaining to the five research questions were developed and sent electronically to 132 public school technology directors across the Commonwealth of Virginia (Appendix C). A cover letter was emailed to each director of technology and the cover letter included the survey web site (Appendix D). The directors of technology were able to click on the web site address in the body of the cover letter and to go directly to the Internet where the survey appeared. The emphases of this study were structured around the methods of assessing instructional personnel on the technology standards in the Commonwealth of Virginia, the perception that these methods were effective and cost efficient, what incentives, if any, were used to motivate instructional personnel to meet proficiency on the technology standards, and the percentage of teachers who demonstrated proficiency on the technology standards as determined by the Virginia Department of Education. Figure 1 demonstrates how these variables were interrelated. The conceptual model variables were covered in Chapter II, the literature review. Additionally, Table 1 defined the variables in this study.

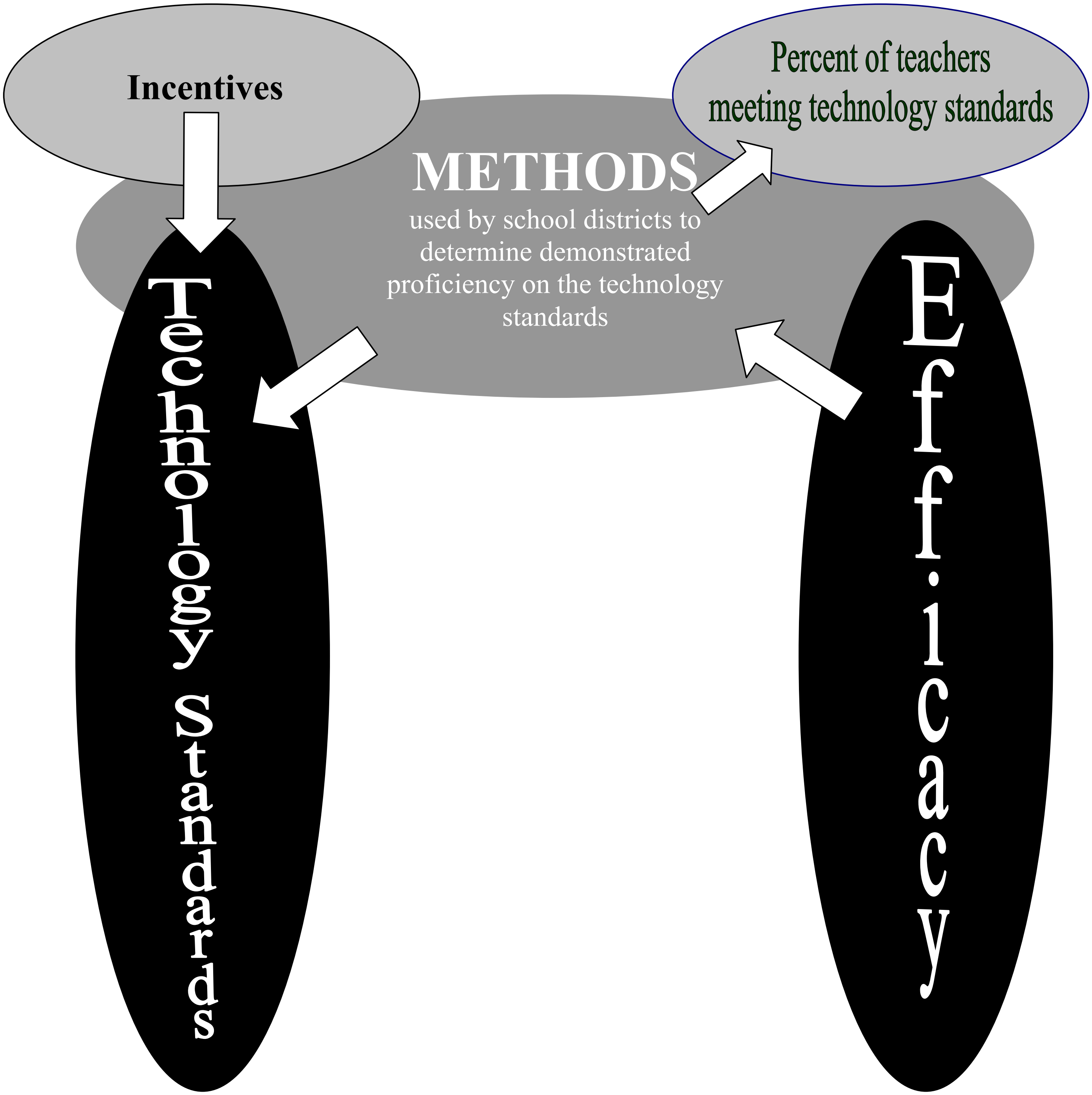

Figure 1. Conceptual model describing method(s) of assessing instructional personnel on technology standards

Definitions

Table 1

Constitutive and Operational Definitions of Constructs

Constructs	**Constitutive definition**	**Operational definition**
District or Division	A division of an area, as for administrative purposes, in this case to identify separate school divisions	*Districts* or *Divisions* will be used interchangeably throughout this study because the researcher found both terms used throughout the literature to mean the same thing
Professional development offered that embeds technology standards in the training	Training approved by the school division that is designed to teach the technology standards	Item checked on the survey
Paper-pencil test	The individual responds to specified items by the school division on paper using a pencil	Item checked on the survey
Computer-based assessment	The individual takes a division wide test on the computer to assess technology skills	Item checked on the survey
Performance assessment on the computer	The individual produces assignments specified by the school division on the computer and sends it electronically to a designated place or teachers are asked to perform several specified tasks on the computer	Item checked on the survey
Portfolio	The individual produces assignments specified by the school division on the computer, prints it out, and keeps it in a notebook or submits a disk	Item checked on the survey

Constructs	Constitutive definition	Operational definition
Signed demonstrated proficiency statement from individual employee	A supervisor of the employee or the employee signs a statement verifying that the teacher met the technology standards	Item checked on the survey
Tangible or intangible rewards offered by the division	The school division provides rewards (monetary, laptop computer, recognition from the school board, relicensure points, etc.) to the individual because he/she met the technology standards	Item checked on the survey and/or a response is written in to an open-ended statement on the survey
Perceptions of effectiveness on the methods that determine proficiency on the technology standards	The respondent states his/her opinion on the grade of effectiveness for the method(s) checked on the survey	The grade of effectiveness chosen by the respondent on a Likert scale
Cost efficient	The respondent states her/his perception of cost efficiency related to the method checked on the survey	Item checked on the survey
Improvement of method(s)	The respondent states how the method, currently utilized in their school division, could be improved	The documented response to an open-ended question on the survey
Radio box/button	The circle on the electronic survey that the respondents click in to indicate their selection	The documented response (click of a mouse) on an electronic survey

Delimitations/Limitation

Directors of technology were selected to respond to the survey. Some directors were more likely to develop the method if not coordinate the method their school division used to assess instructional personnel on the technology standards. In these instances the respondent may be biased when responding to the survey questions (McMillan, & Schumacher, 1989). Also, some school divisions were lacking in personnel and the survey could have been relinquished to someone in the department who knew little about the method or its effectiveness; in this case the lack of knowledge about the method and its effectiveness and cost efficiency could pose a threat to the internal validity of this research design.

Instrumentation. The researcher asked the respondent to grade the effectiveness of the method their school division uses when assessing instructional personnel on the technology standards. The method a school division uses to assess instructional personnel may vary from one school division to another or even within the same school division. For example, workshops might be held after school when teachers could be tired and other schools in the division may hold workshops during the school day with substitutes for the teacher.

Experimenter Contamination/Bias. The administrator, who evaluates instructional personnel on the technology standards, may be influenced by the master teacher versus the novice teacher. For example, if an administrator was assessing a portfolio or performance task, the administrator may be influenced by the topic versus proficiency on the technology standards. The administrator might unintentionally be influenced by what he or she notices in the document (McMillan, & Schumacher, 1989).

History. At the time the researcher sent out the survey to all public school divisions in the Commonwealth of Virginia, the researcher had no way of knowing if there was a turnover of personnel in the department or a budget crisis that might influence the outcome of the results. The survey instrument was designed with the intention that the director of technology or his/her designee would respond without bias or influence from environmental or situational circumstances.

Overview of the Dissertation

This study will be presented in five chapters. Chapter 1 includes the Introduction, Statement of the Problem, Purpose of the Study, Research Questions, Definitions, Delimitations and Overview of the Dissertation. Chapter 2 includes a Review of the Literature and subheadings related to the variables in the study. Chapter 3 discusses the methodology and presents a detailed description of the researcher's survey instrument. The results of the data collection are reported in Chapter 4. Finally, Chapter 5 includes the summary, discussion of findings, recommendations and future avenues of research for this study.

CHAPTER II

REVIEW OF LITERATURE

This literature review was conducted by searching for journals, texts, articles, and dissertations using these descriptors: *technology standards, certification, licensure, instructional personnel, computers, Virginia, methods, assessments*. Ten studies were analyzed to determine what is known about this topic. These studies are charted in Appendix E and described in more depth throughout the literature review.

Chapter II will begin with a general description of the capabilities of technology, a brief history of national teacher certification, and a brief history of Virginia teacher certification. The researcher will then spotlight national technology standards and the Virginia technology standards for instructional personnel.

Two aspects of technology are the consumption of information and the learning environments available to students. The terms, open-ended learning environment and student-centered learning are defined as being those environments that allow the learner to generate and explore his/her own learning (Hannafin, Hall, Land, & Hill, 1994). The twenty-first century training environment is fast becoming computer based (Lohr, 2000). Networking computer systems allow for sharing and exchanging of ideas.

> Computer networking may be the content of a course that deals with the use of network technologies and services and methods for exploiting their potential to the fullest. Alternatively, it can be seen as a tool for supporting individual study and engaging in educational projects (mostly of the collaborative type) on specific subjects based on distance communication (Trentin, 1999, p. 17).

Time magazine heralded the computer as “Man of the Year” on its cover in 1982. Predictions of the technologically advanced classroom were published in magazines across the country and prophecies predicting how teachers will teach and students will learn rang out (Cuban, 1986). One only has to look back approximately 50 years ago when similar predictions were made embracing the television. Some were sure, including policy makers, that televisions would replace the traditional classroom (Cuban). Likewise, the same sentiments are heard regarding the computer.

> Policy makers and practitioners alike are lured by the promise of finally achieving the engineer’s dream of individual instruction through a machine that has the capacity to drill and tutor each student swiftly and cheaply without regard to the pace of classmates, while simultaneously recording and reporting achievement. (Cuban, p.75)

Cuban postulates that there is little evidence to suggest that instruction augmented by technology is any more effective than instruction was previous to the introduction of radio, television, or computer. Regardless, policy makers across the country have established teaching standards that they believe will better prepare our students for the twenty-first century. Teaching standards were birthed in an effort to bring more accountability to the teaching profession and raise student achievement. Awareness in technology research has made its way into the schoolhouse doors under the umbrella of technology standards.

A Brief History of National Teacher Certification

It was not until the late 1800s that certification of teachers was moved to state officials, and longer and more specific written examinations were given to teaching applicants. Yet state officials often empowered county superintendents to examine persons seeking to teach. County superintendents often set their own standards of proficiency and training programs (McCraw, 1987). By the middle of the nineteenth century, teacher training institutions or normal schools were founded. Normal schools consisted of a two-year program with more emphasis on basic subjects akin to today's high school courses. Teacher certification was granted when one graduated from these institutions. State education authorities and, in some cases, state superintendents began exerting their influence over the curriculum of the normal schools to include courses in methods and techniques that teachers would need. The courses began to expand both academically and pedagogically and led to the eventual transformation of teacher colleges (Angus & Mirel, 2001). As cities began to grow rapidly, schools were hard pressed to find qualified teachers. One idea was to establish normal schools in area high schools and the requirements would be that one had to have at least two or three years of high school before entering the normal school. These local normal schools were often empowered by the state education agency to issue their own teaching certificates. They also were able to control the supply and demand of teachers. For example, if they had a plethora of teachers, they would shut down the normal school program for brief periods until the need for teachers existed and then restart the program. They also lowered and raised the entrance requirements based on teacher shortage or overage. This process of training lasted into the twentieth century (Angus & Mirel).

During the early 1900's more men graduated from universities and colleges whereas women graduated from normal schools. The Collegiate Professional Certificate was issued to men graduating from universities and permitted one to teach in elementary or secondary school. The Normal School Professional Certificate was issued to females who attended a standard two-year normal school and allowed women to teach elementary and grammar school (McCraw, 1987).

It was not long before different training regimens existed for rural and urban teachers, mainly because the rural areas were struggling to attract teachers. State authorities decided to help fund teacher institutions in the rural areas but did not have them come under state control, giving much latitude to the county superintendent. Teacher training institutes provided review in basic subjects, some tutoring in advanced subjects, and a few lectures on methods and principles of education. The county also gave their own teachers' exam, which was the concluding activity of the teacher-training institute. This training was delivered in a few days to a few months. Professional educators came to resent the rural teacher institutes partly because their professional guidance was not solicited or acknowledged, but also because this quick in and out training threatened the image of teacher professionalism (Angus & Mirel, 2001).

Politicians began to question the amount of education that licensed teachers had around the country. Educators began looking outside the United States to Europe for pedagogical theories that would prove to be successful. One such lawyer and politician from Massachusetts, Horace Mann traveled to Europe where his views of education shifted to the child. He came back to Massachusetts and shared his views and experiences with leading educators. He shared the pedagogical theories of Johanna Heinrich Pestalozzi. Pestalozzi begins with the child and their world. Pestalozzi is known for object teaching, where one uses an object to gain the attention of the child and more emphasis is placed on the experiences the child has with objects in his environment.   This theory was highly criticized by the schoolmasters of that time who preferred the doctrine of emulation of the teacher and the recitation approach well known and used during that time (Urban and Wagoner, 1996).

Other European philosophers began to surface throughout the Midwest and the East promoting their philosophy and pedagogical methods. Most people outside education saw these

European methods little more than fads. By the turn of the century, professional educators failed to convince ordinary citizens that the task of educating children required specialized knowledge that could only be attained through training. Part of the reason for this failure was the contempt for rural education and the county superintendents lack of interest to propose any viable solutions (Angus & Mirel, 2001).

As the Progressive Era came about, educational opportunities expanded. Teacher unions were founded. The curriculum was reorganized and more student classes were offered, the education of teachers and the structure and design of school buildings improved; pedagogical study became important. This was a time of political change in the control of education. Progressive educators were divided into two camps: 1) Administrative progressives and, 2) pedagogical progressives. The former sought change in management and school organization, while the latter wanted educational practices to be child-centered and to develop a cohesive working relationship between administrators and teachers (Urban & Wagoner, 1996).

Teacher Education and Professional Standards Are Birthed

During World War II and post-war years, a severe teacher shortage existed. Emotionalism tied to patriotism pulled many teachers toward jobs related to the war effort. Teacher salaries could not compete with war related industrial jobs and many teachers did not return to teaching after the war. Additionally, the birth rate after World War II increased magnifying the shortage of teachers. Emergency certificates were issued to teachers at an alarming rate. Initially, elementary schools shouldered the largest shortage of teachers, but as these children grew the shortage extended to the high schools. To attract teachers into the profession, states offered scholarships for positions where shortages were the most severe. Some states introduced retirement plans, sick leave and state minimum salary scales to attract teachers (McCraw, 1987).

Although the teacher shortage continued into the late 1950s, the push for higher teacher standards resumed. By 1953, 25 states required a four-year college degree to teach elementary school. State boards of education were given more authority to establish standards and procedures for certification (Angus & Mirel, 2001). Teachers wanted a voice in the establishment of certification standards, so in 1946 the National Education Association established Teacher Education and Professional Standards (TEPS). TEPS served two purposes: 1) To protect the public from incompetent teachers and; 2) to protect their members from untrained competition, which led in their minds to the demoralizing of the teaching profession.

The TEPS committee was active at national conventions recruiting members and promoting their cause and by 1961 there were TEPS affiliates in every state. TEPS was persuasive with state departments of education to create advisory groups to assist the state officials with certification standards and became an organization unto itself. TEPS was established as a diverse group of broadly represented educators who were ready to be heard. Angus and Mirel (2001) found the following address made by Ralph MacDonald, the first executive TEPS secretary, to the regional conference in 1950:

> The teacher education system of the United States, with the exception of a very few states, is a hodgepodge of programs which are in the main a travesty upon professional education . . . .We even provide a better-planned and better-financed system of professional education for those who raise pigs than we do for those who teach children. (p.24)

Not long after TEPS was organized, it became clear they needed more support to assume responsibility for accrediting teacher programs. As TEPS gained influence, the rumblings of critics gained momentum on another front due to the fear that the American home front was losing power in the face of the launched Russian space rocket, *Sputnik*, in 1957. Panic set in, newspapers reported the fears of political officials, and fingers began to point to the American education system. Critics were given a public platform to voice their complaints, and professional schools of education found themselves defending American education with scholars of liberal arts departments. Because classroom teachers were being crowded out of the National Council for Accreditation of Teacher Education (NCATE), they quickly formed alliances with university liberal arts departments. As the general public became alarmed and asked questions, the education organizations tried to gather control of the situation. They decided to hold national conferences and invited critics to share their concerns in a professional forum.

The Teacher Education and Professional Standards organization held one such conference. The complaints were heavy and extensive. Speakers from the liberal arts camp voiced disgust with the lack of rigor within the education departments including the qualifications needed to enter and exit the program. These critics questioned the intellectual competence of the professors in the education departments and complained that too much clout was given to professional education courses at the expense of academic or liberal arts courses. Probably the most embarrassing criticism was the lack of support for scientific inquiry concerning educational programs already in place. Furthermore, there was no substantial research to link the programs to student achievement.

University liberal arts faculty representatives began to serve on the NEA's and TEPS' national boards, and soon other affiliates asked for representation from the liberal arts departments. Two popular books came out in 1963 in response to the criticism on both sides, *The Miseducation of American Teachers* by James Koerner, and *The Education of American Teachers* by James B. Conant. Koerner's book supported the views of the academic faculty and laid heavy criticism on teacher educators.

Conant's book challenged the academic faculties' claim that more academic courses would be more effective as part of the teachers training program. Conant also rejected the criticism of educational professors by liberal arts professors. Teachers might have been pleased with Conant's book except for what he suggested for certification purposes: "The state should require only (a) that a candidate hold a baccalaureate degree from a legitimate college or university, (b) that he submit evidence of having successfully performed as a student teacher under the direction of college and public school personnel in whom the state department has confidence. . ."(Angus & Mirel, 2001 p. 27). Teachers were infuriated that Conant would suggest that public school personnel have some authority over their training program. In the aftermath of critical books, articles, and debates, TEPS met and made public their organization's recommendation: (a) TEPS should have complete control over certification policy and, (b) TEPS should have complete control over education requirements for perspective teachers (Angus & Mirel).

TEPS assigned another committee to review the proposal, generate discussion, and make revisions before presenting this recommendation to the National State Board of Education. The second committee combined the first two recommendations and submitted three others. This proposal was introduced as Senate Bill 57 in 1961. As controversy over

Bill 57 heated up, other bills were introduced. After two years and nine committees, a bill was adopted in May 1963 that did not resemble the original wording of Senate Bill 57. The revised bill favored the liberal arts faculty, calling for more college requirements in academic subjects and a reduction in professional courses. This bill also required a 5-year program for elementary and secondary teachers.

The National Council for the Accreditation of Teacher Education

Slowly states began to look to the National Council for the Accreditation of Teacher Education (NCATE), which was formed in 1952. NCATE became a coalition to influence teacher education programs and to establish a nationwide system of reciprocity for certified teachers. Six organizations had a total of 19 representatives who served on NCATE. Seven members from the American Association of Colleges for Teacher Education (AACTE), six members from TEPS, three members from the National Board Accreditation, and one member from each of the following: the National Association of State Directors of Teacher Education and Certification (NASDTEC), the Council of Chief State School Officers (CCSSO) and the National School Board Association (NSBA) (Angus & Mirel, 2001). Because of the wide scope of professional involvement, the NCATE became an influential organization.

Today, the National Council for the Accreditation of Teacher Education (NCATE) is an accreditation agency. Their purpose is to ensure that college teacher preparation programs meet high standards and that these high standards measure the candidates' impact on student learning. NCATE has developed six performance-based accreditation standards (see Appendix F). Accreditation of teacher education institutions is voluntary, and states have the authority to submit their institutions to the accreditation process or not. State colleges and universities began to consult with NCATE on teacher preparation programs in the 1980s (National Council for the Accreditation of Teacher Education, 2001b).

At that time states and NCATE had two separate systems of standards. This caused duplication if an institution wanted to be accredited nationally and meet approved guidelines by the state. NCATE's standards for teacher preparation programs were more rigorous and would certainly require program reform. For this reason states were reluctant to form a partnership with NCATE. NCATE wisely offered joint reviews and limited accreditation paperwork as part of the partnership between state colleges and NCATE. As more institutions became accredited under NCATE, other institutions felt pressure to meet higher standards.

The growth of accredited NCATE institutions has been steady since 1990 from 500 accredited institutions to 600 accredited institutions in 2001. Today NCATE is a coalition of 33 organizations comprised of teachers, specialized educators, higher education educators, technology organization members, administrators, and state and local policy makers (National Council for the Accreditation of Teacher Education, 2001a). NCATE works with 46 states now to conduct reviews of education colleges (National Council for the Accreditation of Teacher Education, 2001b).

Currently, 39 states have adopted NCATE standards for all teacher education institutions and 11 additional states grant licensing reciprocity to NCATE accredited institutions (2004). According to the Educational Testing Service, teacher candidates from NCATE accredited institutions passed the Praxis II at a statistically significant higher rate than teacher candidates from non-NCATE accredited institutions (National Council for the Accreditation of Teacher Education, 2001c). The Praxis II was administered to 270,000 teacher graduates between 1995 and 1997; 91 % of teachers from NCATE accredited institutions passed as compared to 84 % of teacher graduates from non-NCATE accredited institutions (2001c).

NCATE had no technology standards until 1997. A task force was formed in 1996 and one year later released a report that recommended teachers use technology as an instructional tool and that institutions integrate technology in their strategic plan. NCATE's goal is to have teacher candidates utilize the Internet successfully (National Council for the Accreditation of Teacher Education, 2001b).

State Data on Teacher Licensure

The Council of Chief State School Officers (CCSSO, 2002) established the State Education Assessment Center to collect information on education in the United States from a state perspective in 1927. In addition to providing state by state achievement data, time and attendance data, graduation requirements, content standards and student assessment data, the CCSSO also provides data on teacher licensure. The last survey report that the CCSSO published was in 2002; at that time 42 states certified or licensed teachers based on state standards for teachers. This is up from 1998, when 34 states certified or licensed teachers based on state standards. Four other states are developing standards. As of 2000 only Arizona, Nevada, New York, and South Carolina did not certify or license teachers based on state standards for teachers. Most states base certification and licensure on the Interstate New Teacher Assessment and Support Consortium (INTASC) standards.

The INTASC is an organization founded in 1987 and made up of primarily state education agencies and national educational organizations (Interstate New Teacher Assessment and Support Consortium, 2002). This organization is responsible for continuous reform in teacher licensure and professional development. Their basic premise is "An effective teacher must be able to integrate content knowledge with pedagogical understanding to assure that all students learn and perform at high levels"(p. 2).

According to the CCSSO (2002) survey, 48 states have a policy requiring professional development to renew teacher licenses or recertify teachers (see Appendix G). In 1992 only 41 states required professional development to renew state licenses or recertify teachers. Most states require six semester credit hours of professional development every three to seven years. Many states allow a choice; for example, teachers may elect 6 semester credits every 6 years or 120 staff development units for recertification or license renewal. At one time Colorado required a portfolio but now requires 6 semester hours or 90 clock hours of professional development every 5 years (CCSSO). Wyoming requires districts to show how professional development activities are related to improving student performance against the standards for teacher recertification. North Carolina requires 15 credits every five years, three of those years must be in technology.

States Requiring Teacher Assessment for New License

William Sanders identified that the statistically most important factor in student performance is the teacher (Sanders, & Horn, 1994). Sanders developed the Tennessee Value-Added Assessment System, which is a mixed-model methodology applied to scaled scores from the Tennessee Comprehensive Assessment Program (TCAP). The TCAP is a state examination given in Tennessee to all second through eighth grade students each spring. This model focuses on student gains from year to year. The idea is that this methodology would identify the value added to the students' scores from one year to the next (Sanders & Horn). One study measured the effects of class size, teacher, heterogeneity, achievement level, and school system on student achievement. There were two significant factors: "The teacher effect is highly significant in every analysis and has a larger effect size than any other factor in 20 of the 30 analyses. The achievement-level effect is significant in 26 of the 30 analyses and has the largest effect size in 10 of the 30 analyses"(Wright, Horn, & Sanders, 1997, p. 61). One can infer from this study that improving teacher effectiveness improves student achievement. Wright et al. (1997) asserted:

> Though the debate about whether student achievement data should be used as part of an assessment, evaluation and accountability system for teachers will assuredly continue…. If characteristics of teaching and learning environments that differentiate teachers who are demonstrably effective (as opposed to ineffective) in different contexts over time can be documented, subsequent teacher evaluation systems might be developed to accommodate these characteristics.(p. 66)

Teacher assessment is widely administered across the country as a means to assess the knowledge and skills of teachers. More states are requiring that teachers pass a state exam to become certified to teach in their respective state. More states are also requiring a portfolio. According to the Council of Chief State School Officers (2002), 44 states administer a written test (see Appendix H). Thirty-seven states use both the Praxis I, academic skills assessment and Praxis II, subject assessments (Educational Testing Service, 2002). Of those 44 states that require a written test, 23 states require a performance assessment either in the form of an observation, portfolio, or both observation and a portfolio. For example, the California State Department of Education requires teachers to meet the qualifying score (which varies according to subject) on the Praxis II single subject tests and to present a collection of evidence known as the California Teaching Portfolio. The portfolio is a reflective process and is intended to take clips of one's work over time. Collecting evidence for the portfolio allows the teacher time for reflection and improvement. Teachers are evaluated as much on the reflective process as the sampled evidence

(California State Department of Education, 2002). In addition to written tests, states are requiring teachers to obtain hours in specific core fields for licensure at the elementary, middle, and secondary levels.

State Requirements in Core Fields for Elementary, Middle Grades and Secondary Teacher License

Since the early 1990s, more states are requiring teachers to major or minor in their teaching field. States across the country are requiring teachers to meet one of the five following criteria to obtain licensure for elementary school: (a) state defined minimum credits in content areas, (b) total credits across four to five subject areas, (c) standards defined by the state, (d) minimum credits in subject area, or (e) an approved teacher education program (see Appendix I, Council of Chief State School Officers, 2002). Thirty-seven states as of 2000 are granting middle school grades licensure as compared to 30 states in 1995 (CCSSO). Middle grades are defined per this survey as grades 4-10 although this varies greatly from state to state (see Appendix J). The trend for secondary licensure (grades 7-12) requires teachers to major or minor in a specific content field, take more credits in the subject, or meet the requirements of a state defined standards program (see Appendix K, Council of Chief State School Officers, 2001). One content field that is emerging as a necessary requirement is technology. States across the country are expanding their standards to include technology.

The History of Licensure in the Commonwealth of Virginia

Some form of teacher competency was expected as early as the 1800s (Edwards, 1985). In 1829 the Acts of Assembly, Chapter 28, gave authority to school commissioners in any Virginia county to fund a good and sufficient teacher not to exceed $100.00 annually. The quality of the good and sufficient teacher was based on the opinion of the school commissioner (Edwards).

In 1846 Chapter 40 of the Acts of the Assembly provided that counties could be divided into school districts and a school commissioner should be appointed for each school district. The school commissioner then elected a superintendent for the district or county for which the school commissioner belongs. Furthermore, the superintendent could request any information from the teacher on the management for the course of instruction taught in the superintendent's schools (Edwards, 1985).

In 1849 Chapter 82 of the Code of Virginia required each school commissioner "to visit the schools, examine or inquire into the character and qualifications of the teachers, and the conduct and learning of the pupils, and note in his register any remarkable instances of superior intelligence or worth among the children entered by him"(Edwards, 1985 p. 2). It should be noted that the Code is silent on how and from where this information would be obtained.

In 1906 all educational laws were consolidated into one act. The act referenced the Literary Fund and provided that every teacher of public free schools hold a certificate issued by the division superintendent prior to 1906 or after that date to be issued by the State Board of Examiners. However, there was no record of what qualifications were needed to hold a certificate until 1936 (Edwards, 1985). There were several regulations, but one interesting fact was that for one to obtain a Collegiate Professional Certificate one needed to complete nine-college session hours in teacher-training courses in the areas of science and library. Also, teachers were expected to obtain one credit hour in school and community hygiene. Teachers were expected to regularly inspect the physical condition of children. For a complete set of these regulations, see Appendix L.

National Technology Standards

Spending for Technology Accelerates Nationally

In 1983 a small volume from the National Commission on Excellence in Education came out, *A Nation at Risk*. It rallied the country around greater accountability for student learning. Policymakers were encouraged to add greater depths of study to the areas of the curriculum requiring math, science and technology. The United States responded by establishing policies, one of which encouraged American companies to invest monies in technological research and development. Consequently, this propelled American private sector firms to create partnerships with federally funded agencies and universities to invest in research and development. These efforts accelerated technological advances in United States industries.

The United States government's primary role is "to focus investments on building assets that remain largely within the country—the people, the infrastructure, and the business climate—freeing the private sector to develop new technology whenever necessary to grow and compete" (Mitchell, 2000, p.10). A historic shift took place in the year 1991 when, for the first time in America's history, our spending accelerated to $112 billion for information technology, exceeding $107 billion spent for Industrial Age capital goods, such as engines, metal works, mining equipment, oil fields, and agriculture costs. This spending marked the beginning of the Knowledge Age (Stewart, 1997). Technology offers us more than information; it gives us choices in communication. The following options are perplexing:

> Printed report, electronic document, magazine article, e-zine article, book, e-book, print ad, TV ad, Web ad, phone call, cell phone call, Internet phone call, voice mail, telemarketing, fax, pager, Web page, e-mail, snail mail, spreadsheet, simulation, database, multimedia presentation, slides, overheads, floppy disk, tape, video, CD, DVD, radio, TV, Web-TV, teleconferencing, virtual reality…choosing the right message for the right audience will be the challenge (Trilling & Hood, 1999, p. 8).

Teacher Preparation Programs Held Accountable

Teacher preparation programs across the nation will be shouldering responsibility to ensure that technology standards are embedded with the traditional teacher-training program of study. The United States Department of Education funded the National Educational Technology Standards (NETS) project through the grant *Preparing Tomorrow's Teachers to Use Technology*. The International Society for Technology in Education (ISTE) developed technology standards known as the National Educational Technology Standards in 1993. These standards have been expanded from four to six categories (see Appendix M). National technology standards were developed with the purpose that teachers need specific technology skills in order to implement and embed technology practices in their classroom lessons, thus ultimately improving the technology skills of their students. Lajeane Thomas, the NETS project director, emphatically said, "To unleash the power of technology in their classroom, teachers must embrace the technology themselves and share their enthusiasm for the learning that ensues with their students"(International Society for Technology in Education, 2000, p. 1). The idea is, as teachers capture the real potential of technology themselves, then their knowledge can be transferred to students. Standards and essential conditions to ensure teachers are prepared to integrate technology throughout the curriculum are recommended to universities and colleges that provide teacher preparation programs. These standards are embedded throughout six categories of the program: (1) Technology operations and concepts; (2) Planning and designing learning environments and experiences; (3) Teaching, learning and curriculum; (4) Assessment and evaluation; (5) Productivity and professional practice and; (6) Social, ethical, legal and human issues.

Train Educators to Use and Integrate Technology in the Classroom

Secondary (high school and middle school) and elementary principals in Southeastern Massachusetts and Rhode Island were surveyed, October through December, 1996, to determine if computers were available in their schools, how much training had been available to teachers, and if pre-service teachers needed as much training as veteran teachers (Sullivan & Keating, 2000). A two-page survey was sent to 266 principals who were randomly selected from Rhode Island and Southeastern Massachusetts; 184 surveys (69%) were returned. Fifty-four percent of the principals indicated that computers were available in every classroom. Computer labs were present in 61% of the schools. The authors did not explain if secondary schools had more computer labs than elementary schools. The rest of the principals reported that computers were available, but not in every classroom. Sixty-one principals (32.6%) indicated that 50-74% of their teachers were computer literate; 65 principals (35%) indicated that less than 50 % of their teachers were computer literate. Only nine principals (5%) indicated that 100 % of their teachers were computer literate. Forty-nine principals (27%) indicated that 75-99% of their teachers were computer literate. Survey responses indicated that computer training for teachers was inconsistent from year to year and that newer teachers were more computer literate than veteran teachers (Sullivan & Keating).

In a West Virginia study data were collected on 950 fifth graders in West Virginia from 18 elementary schools (Mann, Shakeshaft, Becker, & Kottkamp, 1999). This study was conducted during the school year 1996-97. A state education advisory group helped select the 18 schools based on student achievement, perceived intensity of the Basic Skills/Compute Education (BS/CE) program, geography, vendors and socioeconomic status (SES). The selection was a representative sample of West Virginia schools. These fifth graders were the first group of students who had received the BS/CE program since kindergarten; therefore, this grade level had the most complete test scores available since the inception of the BS/CE program.

The BS/CE program focused on three components: (a) software that addressed the division's goals in reading, language arts and mathematics with accompanying data from this variable derived from observation (b) enough computers in the school so that all fifth graders would have ample opportunity to access the programs with accompanying data collected by a yes/no response on the survey, site visits, interviews of principals, teachers and students, and state documents, and (c) staff development for teachers which was measured by survey responses using a 5 point Likert scale and interviews with teachers (Mann, et al.1999). For the purposes of this study, “enough” computers was defined as each classroom having 3 or 4 computers, a printer, and a school wide networked file server. Schools could choose to move the computers in labs, centers or keep them in the classroom. The program’s effectiveness was measured by the fifth grade Stanford-9 Achievement Test scores. Additionally, survey data were collected from 290 teachers in the study schools. Analyzed data consist of surveys on teacher and student perceived attitudes towards computers, Stanford-9 scaled scores, on-site field documentation (availability of computers, teacher training on the software), case analysis and interview results. The findings suggest these factors account for 11 % of the variance in the basic skills gain score and is statistically significant at the .001 confidence level. Findings suggest the gain score can be explained for the BS/CE program. The authors state that the 11 % variance is more representative of one third of the school's reasons why students’ achievement scores improved due to James Coleman’s 1965 findings that family background account for 70% of student achievement, therefore leaving only 30% of student achievement that the school influences. It is this 30% student achievement that the BS/CE program's 11% variance can influence (Mann, et al.1999).

Training teachers and principals on the use of computers and how to use them to enhance instruction needs to be the first order of business, according to Cooley (1998), a former Indiana superintendent, who implemented a technology program in his division successfully. "The success of technology implementation is contingent on a number of factors, including curriculum, instructional leadership, personnel evaluations, staff development, and school environment"(Cooley, p. 2). Principals met with their teachers to discuss the level of computer competency each teacher felt they possessed. From there a staff development plan was designed for teachers and also for principals across the division. Professional goals were also tied to technology competency. Developing professional goals around technology skills helped to create a school climate supportive of technology reform (Cooley).

In one study, the superintendent, Larry Hoover (1997) designed a prototypic model for implementing the Virginia technology standards in Gloucester County Schools. Three hundred ninety instructional personnel completed a needs assessment survey by self-evaluating their present level of knowledge in computer skills. There were approximately 400 instructional personnel in Gloucester County. Since the surveys were administered during a scheduled faculty meeting, there was a high response rate (97%). From the survey data, a staff development model was designed that identified the present level of knowledge and what was expected based on the Virginia standards. An action team was appointed to design the staff development model. The action team was comprised of 10 educators identified by principals and central office staff as being highly proficient in technology. The staff development model was designed according to the data received from the returned surveys. According to Hoover, the process of surveying instructional personnel and identifying the staff development needed to certify competency on the instructional technology standards would be condensed into a booklet that would be available to all instructional personnel in the Gloucester County School division. This brochure would also be shared with the Virginia Department of Education (VDOE).

Achievement Gains Tied to Instructional Technology

The current Bush Administration (United States Department of Education, 2001) “believes schools should use technology as a tool to improve academic achievement, and that using the latest technology in the classroom should not be an end unto itself”(p.1). School divisions across the states are asking themselves whether technology is making a positive difference towards student achievement.

One study by Doherty and Orlosfsky (2001) administered a survey with a sampling error of plus or minus 4.5 percentage points, to 500 seventh through twelfth grade students across the United States in January 2001. The purpose of the survey was to find out student attitudes on technology and learning. The sample base came from 11,051 United States public schools whose students participated in the Market Data Retrieval (MDR) and Harris Interactive Poll. These schools were sorted into four geographic (zip code sectional) areas. The total enrollment was 6,018,084 students. Five hundred students were chosen at random within these four geographic areas. Results found that computers are not often used to help students understand complex or sophisticated concepts, and 50% of the students reported using the computer at school one hour or less a week. Yet, 90% of the students reported that computers were usually available at school. “Students reported that the three most popular activities for which they used school computers were ‘to do research for school assignments’ (96%), ‘to write papers’ (91%), and ‘to do homework’ (62%)”(p. 46).

In another study, Hawkins, Spielvogel and Panush (1996) visited school divisions that were nationally recognized for being technologically advanced. The purpose of this study was to determine (1) what the particular "design" for technology integration at the school site was; (2) whether the use of technology was connected to reform goals, and (3) what was innovative about technology with respect to teaching, learning, or school and district management. The U.S. Department of Education, Office of Educational Research and Improvement funded this study. Thirteen school sites across the country were visited for two to four days by at least two people from the team. At least one person from the team was a senior staff member of the Center for Children and Technology, a division of the Education Development Center, Inc., located in New York City. Information was systematically collected through documents, reports, local news stories, and interviews with staff.

The following key features were identified: leadership, purpose, organized growth, designs for infrastructure, professional development, community connections, software selection, and finance. In addition to the identified key features of the technology proficient school division sites, Hawkins, et al.(1996) concluded that,

> Technologies almost never of themselves caused substantial change in schools. Rather, where there has been success, complex sets of factors change along with the introduction of technologies . . . .Technologies are thus best viewed as playing key roles in solving problems to which they are well suited. (p.1)

Technology Standards for Teacher Licensure and Certification

Teacher quality is in demand, and state policies are changing to meet the high expectations of the public. In fact, significant changes in state policies are tying technology standards to licensure and certification of teachers (Dewert, 1999). A state-by-state education technology policy survey was conducted in all 50 states in 1999 to describe national educational technology trends in the United States. A 75-minute phone interview was administered to all 50 state technology directors. Three questions were related to certification standards. It was interesting to note that while 18 states required pre-service teachers to meet technology-related requirements to receive their initial teaching license, only three states required the same from new administrators. Forty-two states responded *No* to requiring teachers to meet technology related criteria for renewal purposes (Dewert).

Most people have heard the aphorism, *What gets measured, gets done*. Most states are doing exactly that, assessing teachers' knowledge and skills in pedagogy including competency in technology. The public demands it. In fact, several states are mailing *State Report Cards* to taxpayers. These report cards release varying kinds of information on neighborhood schools such as the percentage of students passing standardized tests, as well as the performance of teacher education candidates on statewide technology assessments (Dewert, 1999).

Methods of Assessing Instructional Personnel-Nationally

Most people who graduated from teacher training programs prior to 1990 had no home computer or computer skills. In fact, using a typewriter to complete graduate or undergraduate work was common even in the late 1980s. Since these graduates had little or no computer experience, the responsibility of training and assessing computer skills fell on the backs of school divisions. States may require performance assessments, paper-pencil tests, computer-based assessments, portfolios, professional development or a signed demonstrated proficiency statement ensuring teachers meet technology-related certification standards. Arizona just recently established new teacher certification standards. They intend to develop a paper-pencil test that will assess the new certification standards to include technology (Dewert, 1999). The implications of Dewert's study could initiate a study in Virginia by investigating methods of assessing instructional personnel on the technology standards.

Professional development in technology is one method used across the country to meet required credentials mandated by some states. In Washington County schools in North Carolina, district educators are required to complete 50 hours of technology training within their first two years. Technology leaders are identified at each school to provide training. They receive an annual $100.00 stipend for training educators after school or in the summer. Twenty-three out-of-class hours may count toward the fifty-hour requirement. These hours may be used to read journal articles, complete Internet research, view technology videos, visit businesses that use technology and/or conduct interviews with businesses. Participants will be required to answer questions in a written format pertaining to the out-of-class hours they chose (Gurganus, 2001).

In most instances, division or state policy mandating technology standards determines the type of training or professional development offered to instructional personnel. This is the case in Orcutt Union School District, California, where the state and the district adopted requirements that would demonstrate technology proficiency. California also passed a staff development bill that gave $20.00 per student for staff technology training to schools that demonstrated a student-to-computer ratio of 10:1 in grades four through six (Eyler, 2001). In response to the state passage of the technology bill (AB1339), the district developed an action plan that required all instructional personnel to master two levels of proficiencies. Level One was satisfied when instructional personnel demonstrated using the computer as a tool for acquiring personal information, located information on the computer by manipulating software and hardware devices, and conducted research on the Internet. Level Two was satisfied when instructional personnel applied computer skills to enhance curricula work and used computers to differentiate curricula to meet the needs of students. Trainers received a $750.00 stipend to teach both proficiency levels and train in the portfolio development process. Eyler (2001) did not elaborate on what was required in the portfolio.

Iowa allows the individual districts to determine their teacher standards. There are no state mandated standards; however, there is a generic 3-hour technology requirement for new teachers. Teachers must take one course on computers (J. O'Connell, personal communication, February 7, 2001). Michigan and Alabama allow teacher preparation institutions to design their own programs to ensure that teachers acquire computer knowledge and skills (D. Barlow & S. Ricks, personal communication, February 16, 2001; February 5, 2001). Georgia's currently certified teachers must take a computer skills competency test or an approved training course by June 6, 2006 (Georgia State Department of Education, 2001). Georgia allows for a test-out option, which entails an electronic portfolio and an on-the-job performance assessment. However, when this researcher clicked on the link to find details of the electronic portfolio and the on-the-job performance assessment, a statement popped up on the screen, *Sorry, this page cannot be found.*

Incentives

Some states give teachers individual and organizational incentives to use technology. According to one survey, 15 states offer incentives to teachers for using technology; however, the survey did not elaborate on the extent technology was used or what incentives were given, except to characterize some incentives as financial and others as professional incentives (Meyer, 2001). To help bridge the gap between schools that have technology funds and those that do not, federal dollars from the E-rate program provide funding to schools and libraries that serve poorer students or are located in rural areas. These funds may be used to purchase software programs and to provide infrastructure to support technology and/or train teachers.

Alabama sponsors an annual educational technology conference as an incentive for teachers to learn more about technology and how to use it more effectively in the classroom. The state sends approximately 4,000 teachers a year (Sandham, 2001). Michigan offered a laptop computer to the teachers who passed the basic online assessment. Teachers who qualified for the laptop must complete another online assessment after having used the laptop for one year. Michigan hopes the laptop incentive will encourage teachers to become savvy in computer skills (Sandham). Ohio offers a voluntary certification program for their teachers. Teachers earn novice or practitioner certificates based on how well they align curriculum, instruction, and technology together. No stipends or recertification points were tied to this program (Sandham). Virginia requires teachers to be proficient in technology standards in order to be licensed; one school division offered their teachers $300.00 to pass all three technology competency tests the first try (Smith, 2001). It is interesting to note the range of incentives tied to the use of technology. Everything from intrinsic to extrinsic incentives has been given to motivate teachers to use technology.

Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards

The International Technology Education Association (ITEA) released *Standards for Technological Literacy: Content for the Study of Technology* (STL) in 2002. In the fall of 2003 ITEA released *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (AETL). STL provides standards for the study of technology for students (see Appendix N). AETL supports STL by providing guidelines that address student assessment, professional development of teachers and program standards (see Appendix O). These standards were developed by ITEA between 2002-2003 with grants from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). The intent is to provide formal education to students K-12 so that they will be technologically literate by the time they graduate high school (ITEA, 2003).

ITEA released a guide to assessing students for technological literacy in March, 2004. They expect to release a program guide in late 2004. ITEA also plans to publish a guide on curriculum development and professional development in the future. ITEA is encouraging states, provinces, and policy makers to embrace these standards (see Appendix N-O) and implement these into K-12 schools internationally (ITEA, 2003). The Standards for Technological Literacy is not federal policy or mandated. They do provide the criteria for students to be assessed for technological literacy, however they do not provide an assessment for students or instructional personnel.

Virginia Department of Education Identifies State Standards for Instructional Personnel in Technology

School divisions in the state of Virginia are required to train and assess computer competency of all instructional personnel by July 1, 2003. Instructional personnel whose license expired on or after July 1, 2003 must show proof of demonstrated proficiency on the technology standards or their teaching license cannot be renewed. The license renewal cycle for some teachers may not expire until after the July 1, 2003 deadline; for those instructional personnel, proof of meeting proficiency on the technology standards will not be required by the Virginia Department of Education (VDOE) until the end of their renewal cycle. Currently, some instructional personnel have until June 30, 2008 to demonstrate proficiency. However, local school divisions may choose to require instructional personnel to meet proficiency by July 1, 2003. Once a school division determines that their teacher is proficient on the technology standards and sends verification to the VDOE, then the state accepts that verification for the teacher as being sufficient to meet licensure.

Local school divisions may choose not to accept teachers' proficiency status on the technology standards transferring into their division. In this case, the hiring school division could require the teacher to be proficient by their method of assessing instructional personnel as a condition of employment (Lan Neugent, personal communication, July 16, 2002). The implication here may be that one school division believes their methods for achieving proficiency are of higher quality than other school divisions. School divisions are given great latitude in designing the method of assessing proficiency on the technology standards. There are eight technology standards on which instructional personnel in school divisions across the Commonwealth must demonstrate proficiency (Virginia Department of Education, 1998b). Instructional personnel shall be able to:

> (a) demonstrate effective use of a computer system and utilize computer software, (b) apply knowledge of terms associated with educational computing and technology, (c) apply computer productivity tools for professional use, (d) use electronic technologies to access and exchange information, (e) identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives, (f) use educational technologies for data collection, information management, problem solving, decision making, communication, and presentation within the curriculum, (g) plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational

settings, and (h) demonstrate knowledge of ethical and legal issues relating to the use of technology. p.1.

In addition to school divisions ensuring all instructional personnel meet proficiency on the technology standards, institutions of higher education shall incorporate these same standards in their approved teacher education programs and assess student's demonstrated proficiency of the standards (Virginia Department of Education, 1998b). Effective July 1, 1999, persons seeking initial licensure or license renewal, on and after July 1, 2003, must demonstrate proficiency on the Technology Standards for Instructional Personnel (TSIP).

Educational Technology Plan for Virginia 2003-2009

The Virginia Department of Education developed a technology plan that meets the expectation of the No Child Left Behind (NCLB) Act of 2001emphasizing research based education practices (Virginia Department of Education, 2003). This plan outlines goals and targets for five areas: Integration, professional development, connectivity, educational applications, and accountability. For the purpose of this study, the area of professional development will be examined.

The first target under professional development is: "Educator training programs reflect pre-service course work and experiences that include effective approaches to integrating technology into K-12 education."(VDOE, 2003 p, 36). The technology plan states that progress for this target will be to measure, "The percentage of teacher education graduates who meet the Virginia Technology Standards for Instructional Personnel" and "The number of teacher training programs that include effective technology integration in course work and preservice experiences."(p. 36-37) The evaluation for this target could have implications for another study in Virginia by assessing not only the percentage of teachers who meet proficiency on the technology standards, but also what methods are used to assess proficiency.

The second target for professional development is to offer “A variety of classes, training and resources pertaining to integrating technology effectively. . . ”(VDOE, 2003 p. 37). This target will be evaluated by measuring the:

> The number of educational technology classes and certification programs available to educators; the number of distinctly different, technology-related, staff development activities and training materials available to educators; the quality and availability of staff development activities and training materials as determined by peer assessment; the number of K-12 educators from each school division who successfully complete educational technology courses and certification programs. (p.38)

The technology plan suggested that school divisions evaluate the effectiveness of pre-service technology training programs. Another suggested action was to contract with colleges that offered course work aligned with the technology standards for instructional personnel and/or the international standards for technology education. The suggestions could have implications for another study in Virginia by assessing the effectiveness and cost efficiency of staff development methods that are aligned with the technology standards.

The Educational Technology Plan for Virginia 2003-2009 has developed an accountability piece for this plan. Specifically two targets aligned with the aforementioned goal: 1) All students are technology literate and 2) All instructional personnel are technology literate. The plan gives the reality, gap analysis and progress measures for both targets.

For the first target (students) the plan reports the scores on the fifth and eighth grade SOL 2002 computer/technology test. Yet, there is no mention of measuring these tests again for 2003-2009, the duration of the plan, because Virginia has abolished testing computer/technology skills. Instead, the state will measure, “The percentage of principals reporting that observations and teachers’ lesson plans indicate Computer/Technology Standards of Learning are being seamlessly integrated into appropriate curriculum areas”(VDOE, 2003 p. 87).

For the second target (instructional personnel) the plan states the reality is that each school division has its own definition and method of assessing technology literacy, the plan also suggests that assessment tools for technology literacy of instructional personnel need to be developed and shared. The VDOE will measure the progress of this target by reporting: “The percentage of divisions that have such an identification and assessment tool in place”(VDOE, 2003 p. 88). The information from this plan may have implications for another study in Virginia that provides the percentage of school divisions that have developed a method of assessing instructional personnel on technology literacy.

The third and final target for professional development is to provide a variety of topics on technology and delivery methods. This target will be measured by: “The number of technology-related staff development activities offered or supported by and among school divisions, by professional organizations, by business and industry, by public broadcasting entities, by the Virginia Department of Education and the quality and availability of technology-related staff development activities as measured by peer assessment.”(VDOE, 2003 p. 39).

Methods of Particular Interest to This Study

Two studies that addressed methods of assessing instructional personnel on the technology standards in the Commonwealth of Virginia are Hoover (1997) and Bartley (2001).

The first study, Hoover (1997) described a staff development model designed to ensure teacher competency on the Virginia technology standards. Bartley (2001) interpreted technology standards through the elementary teachers' perspective. These two studies will be discussed in depth in the following section.

Hoover's study (1997) was conducted in Gloucester County Schools. A staff development plan was designed for Gloucester County Schools instructional personnel in order to help them meet proficiency on the Virginia technology standards. The staff development plan was comprehensive and by itself could be used as one method of assessing instructional personnel in Virginia schools by the wording of the *Code of Virginia* §22.1-16 ([see Appendix A] Virginia Department of Education [VDOE], 1998b). Additionally, an assessment component was developed. The plan addressed the eight technology standards required by the VDOE.

For the first standard, *operate a computer system and utilize software*, the plan called for the teacher to perform specific tasks on the computer while an evaluator checked off the completed task. This checklist was then placed in that teacher's portfolio. The checklist form was downloaded and printed on a CD-ROM (Hoover, 1997).

For the second standard, *apply knowledge of terminology associated with educational computing and technology*, the teacher performed specific tasks on the computer that demonstrated proficiency of this standard. For example, the teacher was required to open a software program from a CD-ROM. This was a matching exercise that required the teacher to utilize the mouse to drag and drop pictures or words to the respective definition. Terms such as *monitor, keyboard, diskette, hard drive, mouse, memory*, and *RAM* were tested. The completed task was printed out and put in a portfolio (Hoover, 1997).

For the third standard, *apply productivity tools for professional use*, the teacher was asked to create four documents: word processing, database, spreadsheet, and overhead slide. These documents were printed and placed in a portfolio notebook. For the fourth standard, *use electronic technologies to access and exchange information*, the teacher was asked to go to a website that identified a browser and print it; enter a search term and print it; write and send an email and print it; pull up an online encyclopedia page and print it. All the printed documents were placed in the teacher's portfolio (Hoover, 1997).

For the fifth standard, *identify, locate, evaluate, and use appropriate instructional technology-based resources (hardware and soft ware) to support Standards of Learning (SOL) and other instructional objectives,* the teacher completed three different paper and pencil surveys listing relevant grade-level electronic resources available in the library . The teacher identified software that was available in the school to enhance instruction, and listed the titles of voice and video technologies that one could use to address the SOLs. All three of these documents were placed in the teacher's portfolio. Additionally, the teacher was required to insert two student-work samples from two software programs identified in the survey. These two samples were placed in the teacher's portfolio (Hoover, 1997).

For the sixth standard, *use educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum,* the teacher provided two self-generated documents from the following choices: word processing, spreadsheet, database, and/or telecommunication. The two documents were placed in the teacher's portfolio. Also, the teacher was required to place two student work samples in the portfolio to demonstrate that the students were engaged in the following: word processing, spreadsheet, database, and/or telecommunication (Hoover, 1997).

For the seventh standard*, plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings*, the teacher generated two documents in the form of lesson plans that demonstrates the teacher's integration and utilization of any two of the following: telecommunications, single computer, computer lab, and/or automated library. These documents were placed in the teacher's portfolio. The eighth standard, *demonstrate knowledge of ethical and legal issues relating to the use of technology*, was not tested; however, the pilot group recommended that these topics be stressed in all staff development sessions (Hoover,1997).

Once the portfolio was completed, the building principal or principal's designee reviewed the portfolio with the teacher. If the principal or the designee was satisfied with the components of the portfolio, the teacher and the principal or the principal's designee signed a form. The form was sent to the Human Resources Department of Gloucester County Schools, indicating that the teacher had demonstrated proficiency on the Virginia technology standards (Hoover, 1997). Cost effectiveness was not discussed in this study; in fact, no reference to a budget or monetary source was mentioned. The effectiveness of the program was not evaluated by the pilot group or the action committee, except to say that the survey to determine staff development needs of the pilot group was given again after the staff development training was administered to the pilot group. Noticeable improvement was seen on standards 1, 2, 3, 6, and 8 where 7% or more of the pilot participants rated themselves at the user, advanced, or instructor level. The pilot group also improved on standards 4, 5, and 7, but to a lesser degree. Hoover's study has implications for another study in Virginia, which could describe the methods of assessing proficiency on the technology standards for instructional personnel in the Commonwealth of Virginia. In addition, one may determine the efficacy of those methods.

Bartley's qualitative study (2001) suggested that the language of the Virginia technology standards was too ambiguous and led to confusion, and furthermore, the technology standards should not be the same for elementary and secondary instructional personnel. Bartley's study takes the elementary school's perspective and recommended standards more fitting to the elementary culture. Ten teachers from one elementary school in Virginia participated in this study.

The study did not divulge the school's or district's name, except to say it was a moderately large school system in Virginia with 12,000 students. The teachers represented a cross-section of the instructional staff at this school. A teacher from each grade level, kindergarten through fifth grade, and a representative from each of the following departments; administration, special education, technology support personnel, and non-content specialty areas were selected. This study indicated that most of the teacher participants had taken district level technology classes and technology classes at the University of Virginia School of Continuing and Professional Studies. Technology certificates were administered at the successful completion of these courses at the University of Virginia. The certificate served as documentation for demonstrating proficiency on the technology standards for teachers in this school system (Bartley, 2001).

Bartley (2001) studied these "10 technologically involved elementary teachers. In essence, this research focused on the process of establishing what these 10 teachers knew by discussing and reflecting upon their current technology beliefs, skills and practices" (Bartley, p. 27). The methods used in this study included group discussions, observations, a survey and written communication. Bartley wanted to know how these ten teachers interpreted the eight technology standards for instructional personnel in Virginia and also wanted to make some suggestions in the language of these standards for better understanding.

Ten teachers were split into three teams. Likewise, the eight technology standards were divided, and each team of teachers was given two standards and one common standard to evaluate. The first standard, *Instructional personnel shall be able to demonstrate effective use of a computer system and utilize computer software*, was not used “because the requested competencies were inherent in the other standards”(Bartley, 2001, p. 73). The last standard, *Instructional personnel shall be able to demonstrate knowledge of ethical and legal issues relating to the use of technology,* was the common standard given to each group. The teachers in the group were asked to write down their individual perceptions of what they interpreted each standard to mean and how they were implementing the standard in their own teaching. Bartley typed up the individual’s responses to each standard but kept the teacher’s name anonymous and shared the responses with the entire group.

The first group meeting centered on open discussions to the written responses with all ten teachers; the discussions were audio-taped and transcribed. The group met again, but this time they discussed how the standards could better reflect the elementary culture. During this session groups used chart paper and rewrote the standards to give clarity and purpose with respect to the elementary culture. Again, this session was audio-taped and transcribed. The third meeting Bartley distributed a written survey of ten questions that reflected the ideas and concerns brought forth in the group sessions. The survey was explained and designed for self-reflective purposes only. The responses were not collected or transcribed. Other information was distributed such as the current version of the state’s technology standards and each group’s summaries to the discussion of the standards. At the fourth and final meeting, only two groups met to review the proposed revisions of the standards and prepared a final version. Additionally, an assessment recommendation was proposed for one standard to read "Assessment: On-going portfolio assessment; part of yearly evaluation would be observation of a lesson including technology; class participation should count for something"(p.194, Appendix E). The results of this study were made available to the teachers, the county, and the Commonwealth of Virginia in the hopes that these finding will affect future decisions regarding the technology standards. The implications in this study for a similar study could be examining other schools interpretation of Virginia's technology standards by the method of assessing teachers' proficiency on the technology standards. For example, the method a school division chooses to assess proficiency on the technology standards could be insightful to the interpretations of what the technology standards mean to that school division. Also, of particular note, Bartley (2001) briefly referred to four districts in Virginia using different methods of assessing instructional personnel (professional development courses, portfolio, performance assessment on the computer and a signed demonstrative proficiency statement); again this information could have some implications on other studies in Virginia.

Chapter Summary

Teaching standards were birthed in an effort to bring more accountability to the teaching profession and raise student achievement. Teachers were *born* in the 1800s; and their reputations, based on their morals, had more to do with acquiring the status of *teacher* than any formal teaching training (Angus & Mirel, 2001). That acquisition of status quickly changed with the supply and demand ratio. As students required more education, teachers had to stay a step ahead, thus teachers required more training. By the late 1800s, state officials began establishing teaching credentials and issuing teacher certification, thus usurping authority over local officials. This transition was easier in urban areas than rural areas. New York, Rhode Island, and Arizona were the first three states that approved the state issuance of teacher certificates.

A severe teacher shortage occurred during World War II and post-war years (Angus & Mirel, 2001). During this time, emergency certificates were issued to teachers at an alarming rate. Although the teacher shortage continued into the late 1950s, the push for higher teacher standards resumed. By 1953, twenty-five states required a four-year college degree to teach elementary schools. Teachers wanted a voice in the establishment of certification standards so in 1946 the Teacher Education and Professional Standards (TEPS) was born and supported by the National Education Association. TEPS had two purposes for their organization: (1) to protect the public from incompetent teachers and (2) to protect their members from untrained competition (Angus & Mirel).

In 1957, the Russian space rocket, Sputnik, was launched and for the first time in American history, the general public began to question the quality of our education system (Angus & Mirel, 2001). Slowly, states began to look to the National Council for the Accreditation of Teacher Education (NCATE), which was formed in 1952. This became a coalition to influence teacher education programs and to establish a nationwide system of reciprocity for certified teachers. NCATE continues to have a strong influence on teacher standards today. Their purpose is to ensure that college teacher preparation programs meet high standards and that these high standards measure the candidates' impact on student learning.

The history of Virginia certification mirrors the history of national certification, in that the school commissioner in all Virginia counties was given authority to hire a *good and sufficient* teacher in 1829. The criteria of *good and sufficient* were left to the judgment of the school commissioner. Twenty years later, the school commissioner was required to visit the school and to inquire into the character and qualifications of the teacher. The school commissioner was required to make a written record of this visit and note instances of superior intelligence or worth among the children. There was no record of what qualifications were needed in the state of Virginia to hold a teaching certificate until 1936.

The Council of Chief State School Officers (CCSSO,2001) established the State Education Assessment Center to collect information on education in the United States from a state perspective. Their reports provided state-by-state achievement data, time and attendance data, graduation requirements, content standards, student assessment data, and data on teacher licensure.

Teacher assessment has come full circle in the process of teacher certification. In the 1800s teacher assessment, however crude, was the norm. Teacher assessments became more tailored according to the level of education one received prior to becoming a teacher. As more specialized training was required of teachers, certification officials began to see no need for teacher assessment. Vermont was the first state to eliminate testing in 1912, and by 1937 twenty-seven more states followed Vermont's lead. Today teacher assessment is widely administered across the country as a means to assess the knowledge and skills of teachers. More states are requiring teachers to pass a state exam to become certified to teach in their respective state (Council of Chief State School Officers, 2001). Thirty-seven states use both the Praxis I, academic skills assessment, and Praxis II, subject assessments (Educational Testing Service, 2002). In addition to teacher assessment, some states required a portfolio, a collection of evidence that required teachers to reflect on their work and the value of their lessons over time. The portfolio has not been that popular and currently only California requires the portfolio.

Teacher preparation programs across the nation will be shouldering responsibility to ensure that technology standards are embedded within the traditional teacher-training program of study. The International Society for Technology in Education (ISTE,2000) developed technology standards for teachers in 1993 and has gone through two revisions since then.

School divisions in Virginia are challenged to craft staff development to meet the individual needs of current instructional personnel on the technology standards. James Hoover, the superintendent of Gloucester County Schools in Virginia, developed a staff development model that would design training specific to the needs of his instructional employees. This model was developed around the technology standards required by the Commonwealth of Virginia (Hoover, 1997). School divisions in the state of Virginia are required to train and assess computer competency of all instructional personnel by July 1, 2003. If one does not meet competency as determined by the school administrator by July 1, 2003, then that person's teaching license will not be renewed. Another study (Bartley, 2001) proffered that the language of the Virginia technology standards be revised to clear up ambiguity. Furthermore, Bartley offered revisions to these standards with one recommendation for assessment for one of the eight mandated standards.

Ten studies were reviewed in detail throughout Chapter II and listed in Appendix E in the order they appear. These studies were charted in the Appendix by: citation, purpose, methods, findings, and implications. Although all of the studies gave structure and value to this study, two studies, Hoover (1997) and Bartley (2001) were directly related to the technology standards mandated by the Department of Education in the Commonwealth of

Virginia. It was for this reason that considerable attention to detail in methodology was given to Bartley's and Hoover's studies. Both studies related to the statement of the problem cited in this paper.

CHAPTER III

Methodology

The purpose of this study was to identify what methods school divisions across the Commonwealth were using to assess instructional personnel on the Virginia technology standards. Additionally, the researcher wanted to know if these methods were effective and cost efficient; if there was any incentives used and what percentage of teachers had met proficiency on the technology standards as of June 30, 2002. As a result of the literature review five general areas were investigated as part of this study. The first area identified the methods that were used to assess demonstrated proficiency on the Virginia K-12 public school teacher technology licensure standards and any recommended modifications to these methods. The second area identified perceptions of technology directors on the effectiveness of each method. The third area identified perceptions of technology directors on the cost efficiency of each method. The fourth area identified incentives school divisions offer to instructional personnel who met demonstrated proficiency on the technology standards. The fifth area identified the percentage of teachers who met the technology standards as of June 2002.

There were five research questions: 1. What methods are school divisions in Virginia using to determine demonstrated proficiency on the technology licensure standards for teachers? 2. How effective is each method as perceived by the division's technology director? 3. Is the method cost efficient as perceived by the division's technology director? 4. What incentives are school divisions in Virginia offering to instructional personnel in order to meet demonstrated proficiency on the technology standards? and 5. What is the percentage of teachers who met the technology standards as of June 30, 2002? An electronic web-based survey was distributed to all division-wide technology directors across the Commonwealth of Virginia in order to gather data on the five research questions. This chapter provides detailed information about the population, instrumentation, instrument pilot, data collection procedures, and methods of analysis.

Population

The population of public school division-wide technology directors in the Commonwealth of Virginia was selected to respond to the survey. The names of these directors were found on the Virginia State Department web page and confirmed through personnel at the Virginia Department of Education. Currently, there are 132 school divisions' technology directors. This population was selected because technology directors are deemed to be most familiar with the processes used to assess instructional personnel, and they most likely oversee the implementation and administration of assessing instructional personnel for the Virginia technology competencies (L. Neugent, personal communication, December 12, 2000). In those rare instances where directors of technology do not have direct responsibility for overseeing demonstrated proficiency of technology standards in their school division, the instructions requested that they forward the web-based survey to the person who does (R. Kapoor, personal communication, April 5, 2001).

Instrumentation

The researcher collected information on the methods school districts are using in the Commonwealth of Virginia to assess teachers proficiency on the technology standards. After reviewing literature on survey designs, the researcher developed a self-designed, survey instrument (Creswell, 1994). Instead of mailing the survey, the survey was accessed through the Internet on the World Wide Web. This appealed to the respondents by the fact they are directors of technology and they access computers and the Internet as part of their regular job responsibilities. The researcher emailed each director of technology a cover letter (See Appendix D). The cover letter contained the Internet link so that when they click on it, the survey opened up at that Web site. Each school division was assigned a PIN #. The web application restricted multiple entries, in other words, only one survey application was accepted from each school division. The researcher hired a computer programmer to program the application on the Internet. Once technology directors completed the survey they clicked on a button that read *Submit Form.* The researcher was able to download the completed survey and began to analyze the data once the survey was submitted. These data are reported in Chapter four.

The researcher viewed survey questions in the General Social Survey sponsored by the National Opinion Research Center at the University of Chicago (Fowler, 1993). This along with survey literature, suggestions from the researcher's committee and the pilot group provided the structure for this study's survey (See Appendix C). The content of the survey is derived from the research questions. Six methods of assessment listed in the survey came from two sources: informal dialogue with principals in the Tidewater and Northern Virginia area and methods identified in Hoover (1997) and Bartley's (2001) study previously stated in this paper.

According to Bourque & Fielder (1995) the survey topic should be clearly defined and reasonably covered. All items should be interrelated to the focus. For the purposes of this survey, the researcher identified and numbered the methods of assessing personnel on the technology standards vertically on the left-hand side of the survey. The respondents were asked to indicate if they used the method by clicking in the radio box (•) below the *Y*, indicating yes or clicking in the radio box below the *N*, indicating no. If the respondent clicked in the *Y* radio box on the electronic survey and then decided to select the radio box under *N* the first response under Y would be eliminated. The radio boxes were placed below the *Y* and the *N* because it clarifies for the respondent what answer is selected as compared to placing the radio box to the side of the *Y* and *N* and leading one to wonder if checking the radio box meant *yes* or *no* (McMillan & Schumacher, 1989).

There were two more columns to the right of the methods titled: *Column A What grade would you give the effectiveness of this method?* and *Column B Is this method cost efficient?* In Column A the respondent was given a five descriptor Likert scale in the form of a grade; *A, B, C, D*, or *F.* The *A* indicated extremely effective, and the *F* indicated extremely ineffective. The dangers of choosing a five-descriptor Likert scale were that some respondents might gravitate to the middle (Fink, 1995). In this study, the middle would be the grade *C;* however, because beliefs or opinions are usually graduated in nature, a Likert scale can be an effective means of measuring perceptions (McMillan & Schumacher, 1989). Another point to consider is if the researcher eliminated a five-point scale in order to force the respondent to choose between two extremes of the scale, the researcher may have risked the respondent not reflecting an accurate response or not responding to the question (McMillan & Schumacher, 1989). The researcher chose a grading scale Likert *A, B, C, D* and *F* because school divisions are institutions familiar with a grading scale. An *A* is valued as extremely effective and *F* indicates failing or extremely ineffective.

For the next section, *Column B Is this method cost efficient?* the researcher chose a categorical response of either *Y*, indicating yes or *N*, indicating no. The respondent was able to select only one answer. For questions that could be answered with a categorical response or a closed form response, such as clicking *Y* for yes or *N* for no then it keeps the respondent on the subject, it takes little time and it is easy to score (Best J.W., 1970).

The respondent was asked to identify the percent of teachers who have met proficiency on the technology standards as determined by the Virginia Department of Education, as of June 30, 2002. The directors' of technology from individual school divisions across the Commonwealth of Virginia provided this information. The date June 30, 2002 was chosen because the school year calendar for most school divisions in Virginia are completed by June 30 of any given school year and this survey was electronically mailed out December 5, 2002.

The next item on the survey was a list of incentives that school divisions might offer for meeting proficiency on the technology standards. The incentives were listed vertically for the respondent to check off if they offered that incentive in their school division. The respondents were able to select more than one incentive listed on the survey; also there was an opportunity for the respondent to write-in an incentive not already listed.

The Web-based survey represented a mixed model (Tashakkori & Teddlie, 1998) or a mixed methodology design (Creswell, 1994). There were closed-ended and open-ended items on the survey. Up to now only closed-ended, quantitative items have been discussed, with the exception of the write-in incentive. Additionally, there were two open-ended questions. The responses are qualitative in nature. A write-in box was located after each method was listed on the survey with the exception of the method, *Signed Demonstrated Proficiency Statement*. Once the respondent selected the methods that are used in their school division then they were asked to *Briefly describe the method your school system uses in the write-in box below.* This allowed the respondent to tell the researcher more about the particular method. The researcher identified similar phrases, patterns, and relationships in respect to the methods (Miles & Huberman, 1994). These data were captured in tables and figures. Tables and figures allowed the researcher to compress data in an organized format that permits one to draw conclusions (Miles & Huberman, 1994). The format of these tables and figures are described later in this chapter under *Method of Analysis.*

The second open-ended response question was: *If you graded the effectiveness of your school division's method a C or below, please identify the method and then specify how this method could be better*. The researcher looked for common themes that were recorded from other directors of technology as they specified how a method could be improved. The researcher believed these open-ended questions projected a richer description of the data and revealed some complexity to the methods used across the Commonwealth of Virginia (Miles & Huberman, 1994).

Finally, demographic information was requested at the end of the survey. The researcher viewed surveys sponsored by the National Opinion Research Center at the University of Chicago specifically the General Social Survey and found that they placed the demographic information at the end of the survey. This worked well for this researcher because she wanted the energy from the respondents to focus first on the survey items. The researcher posed two questions to directors of technology: *May I contact you by phone or email for clarification or more information?* The respondent clicked the radio button for *Yes* or the radio button for *No*. The respondents were directed to enter their name, title, email address, phone number, home address, city, state, zip code in the place provided if they clicked *Yes*. The second question read: *Would you like a summary of the results of this study? Yes* or *No*, again the respondent was directed to enter name, title, email address, phone number, home address, city, state, and zip code in the place provided if they clicked *Yes*. Finally, the respondent clicked the *Submit* button and a message from the researcher popped up that stated: *Thank you for your time, I greatly appreciate it!*

As the researcher designed the survey, it became evident that both qualitative and quantitative data needed to be collected to best answer the research questions on effectiveness.

> Each of these approaches to data collection alone might provide insufficient and/or partially incorrect data. Combining the two approaches (what Sechrest and Sidani call multiple measures or complementary measures) provides richer data than either approach. The alternative approach either validates the data collected through the other approach or complements (adds to) such data.(Tashakkori & Teddlie, 1998 p. 95)

The researcher believes that the information collected through quantitative and qualitative measures provided a richer description to the methods used in public school divisions across the Commonwealth of Virginia.

Instrument Pilot

The researcher piloted the survey instrument two different times, the survey was piloted the first time on June 15, 2001 by presenting it to 23 Computer Resource Teachers (CRT) in a large suburban school division in Eastern Virginia. Computer resource teachers were chosen because they are knowledgeable about the technology standards and are familiar with various ways to assess instructional personnel on technology standards. The pilot was administered to test content validity and to review and modify the definitions of the constructs. Each CRT was given the instrument and the researcher read the cover letter to them. They were asked to read the survey to determine (1) if the questions made sense; (2) if they understood what the researcher was asking; and (3) if the questions were clear. The researcher polled the group with a show of hands as they reviewed each method and section of the survey instrument. A discussion ensued throughout the pilot. The following suggestions were offered by consensus: (a) give an explanation under the method *Paper/Pencil Assessment*, (b) give an example of electronic portfolio and portfolio under the method *Performance assessment*, (c) redefine electronic portfolio to read *Performance assessment on the Computer*, (d) list all the incentives together instead of listing some under *Recognition of school board*, (e) remove the word *approximate* before the word *percent* for question 2, and (f) add the word *Title* after the word *Name* on the bottom of the second page of the survey. These changes were discussed with the researcher's chairperson for approval.

The researcher's dissertation committee offered suggestions to clarify the method *Professional Development* by separating *workshops*, *college courses* and *mentoring* on the survey. Constitutive definitions of the constructs within the body of the paper were placed under each method in the survey, and a write-in box was placed under each method, with the exception of the sixth method a *Signed Demonstrated Proficiency Statement.* Placing the write-in box allowed for the directors of technology to describe or explain their method of assessing instructional personnel in their school division. This helped the researcher derive meaning from the method selected (Creswell, 1994). Another question, pertaining to cost efficiency was reformatted on the survey to read, *Is this method cost efficient?* The respondent selected *Y* for yes or *N* for no. The question previously read, *What grade would you give the cost efficiency of this method?* A Likert scale of *A*, indicating extremely cost efficient to an *F*, indicating extremely cost inefficient was offered. The researcher chose to put more emphasis on the effectiveness of the method as to cost efficiency on the technology standards. Therefore, the researcher chose to present the Likert scale for the question, *What grade would you give the effectiveness of this method?* and further the meaning of this quantitative measure by inserting an open-response item that allowed the respondent to specify how this method could be better if a grade of *C* or below were given.

The survey was piloted the second time on October 27, 2002 after the modifications from the first pilot were made and suggestions from the researcher's committee were implemented. This pilot was administered to one middle school principal, two elementary school principals and one computer resource specialist from a large suburban school division in Eastern Virginia. Also, one doctoral fellow at the College of William and Mary was administered the survey test pilot. Additionally, the revised survey was sent to two committee members for review and comments. The following suggestions were made by the seven reviewers: (1) lengthen the methods column to include the definitions of each method as defined in the paper; (2) move the location of the *Professional Development* method below the *Paper/Pencil Assessment*; (3) separate the reliability and the validity question into two questions under the paper/pencil method; and (4) emphasize the *Used?* column under the directions by bolding the word; *Used?*

The researcher examined the length of time it should take to complete the survey. According to the federal Office of Management and Budget, self-administered surveys should be short and it should take respondents no longer than 30 minutes to complete the survey (Fowler, 1993). The time it took for completion of this survey instrument ranged from 8 to 15 minutes.

Data Collection Procedures

All data were collected from the survey titled, *Methods Used to Determine Technology Competencies for Virginia Teachers*. The researcher secured email addresses for all technology directors from the Virginia Department of Education's Assistant Superintendent of Technology office (L. Neugent, personal communication, July 8, 2002). The survey was formatted so that the respondents could click or type in the responses on the survey form and submit it electronically.

Quantitative data were entered into the Statistical Program for Social Studies (SPSS) software program and is explained in more detail in this chapter under *Method of Analysis*.

Two weeks after electronically transmitting the survey, a reminder was sent electronically to non-respondent individuals with a survey as an attachment. Likewise, an electronic thank you was sent to responding individuals (Fink, 1995). All surveys were dated electronically as they were returned. Also, all surveys have been treated confidentially. The researcher expected a high rate of return for three reasons: (1) this survey was sent to technology directors already interested in this topic by the nature of their position, (2) the Virginia State Department of Education has charged all school divisions to develop a technology plan that assesses instructional personnel, and (3) technology directors are accustomed to email and designing electronic forms themselves (L. Neugent, personal communication, December 12, 2000). Therefore, 132 surveys were sent to Virginia school division directors of technology. Ninety-seven surveys (72%) needed to be returned in order to infer appropriate generalizations across this population (Krejcie & Morgan, 1970). The researcher received 104 surveys for a 79% return.

Method of Analysis

Once the surveys were returned, the researcher gathered qualitative and quantitative data from each survey that supports the five research questions: Tables, figures and appendices (Miles & Huberman, 1994) captured both qualitative and quantitative data linked to the research questions. The researcher analyzed the results to the first research question: *What methods are school divisions in Virginia using to determine demonstrated proficiency on the technology licensure standards for teachers?,* by reporting the number and the percentage of respondents who indicated *yes* meaning that the respondent used that specific method to assess instructional personnel on the technology standards. This information is reflected in one table. The methods were listed down the far left column of the table. Across the top of the table, their were 5 columns which indicated: (1) The number of school divisions that used the method, (2) the percentage of school divisions that used the method, (3) the number of school divisions that did not use the method, (4) the percentage of school divisions that did not use the method, and (5) the total number of school divisions that responded to that method. The next table displayed the number of methods used down the far left column of the table (one through eight) and the second column indicated the number of school divisions that used that number of method(s).

Additionally, the researcher reported the qualitative data linked to the first research question on the survey that states: *Briefly describe the method in the write-in box below* in a table. The researcher listed the descriptors of each method as reported by the respondents on the survey. The researcher paraphrased the respondent's script using summary phrases to capture the description of each method. The researcher clustered similar descriptors and attached a label to like descriptors for each method (Miles & Huberman, 1994). These labels are identified as domains in the respective tables in Chapter IV.

The researcher analyzed the results to the second research question: *How effective is each method as perceived by the division's technology director?,* by reporting the number and percentage of respondents who graded the effectiveness of each method an A, B, C, D or F. The researcher assigned a value of: 5=A, 4=B, 3=C, 2=D and 1=F as she entered the data into SPSS. This information was extracted from a frequency distribution table in SPSS and entered into Table 12 in Chapter IV. Additionally, there was another question on the survey that linked qualitative data to the second research question. The question on the survey asked: *If you graded the effectiveness of your school division's method a C or below, please identify the method and* *then specify how this method could be better?* The researcher summarized the comments in Chapter IV. The complete list of comments were grouped by method and placed in Appendix V.

The researcher analyzed the results to the third research question, *Is each method cost efficient as perceived by the division's technology director?* by reporting the number and percentage of respondents who indicated *Yes,* meaning the method is cost efficient and the percentage of respondents who indicated *No,* meaning the method is not cost efficient. The researcher assigned a value of: 1=Yes, and 0=No as she entered the data into SPSS. This information is reported in Table 14 in Chapter IV. The methods are listed down the far left column of the table and the second column indicated the number and percentage of school divisions that responded *Yes* or *No* to the survey question, *Is this method cost efficient?* The last column of the table indicated the total number and percentage of surveys that were returned for each method.

The fourth research question, *What incentives are school divisions in Virginia offering to instructional personnel in order to meet demonstrated proficiency on the technology standards?* The researcher analyzed the results to the fourth research question by reporting the number of respondents who indicated their school division used one or more of the six listed incentives. The researcher calculated the frequency each incentive was reported. These data were entered into a table in Chapter IV. Additionally, the researcher collected responses to: *other type of incentive*, *please specify*: on the survey. The write-in incentives were listed by frequency and those incentives are reported in Table 15 in Chapter IV.

The fifth research question refers to the percentage of the teachers who met the technology standards as of June 30, 2002. The researcher analyzed the results to the fifth research question by reporting the number of school divisions and the percentage of instructional personnel who met proficiency on the technology standards. This information is reported and entered into Figure 2 in Chapter IV. Finally, the researcher received IRB exemption approval for this study.

Chapter Summary

Five objectives guided this study: (1) To identify the methods that are used to assess demonstrated proficiency on the Virginia technology licensure standards, (2) to identify perceptions of technology directors on the effectiveness of each method (3) to identify perceptions of technology directors on the cost efficiency of each method, (4) to identify incentives that school division's offer to instructional personnel who met demonstrated proficiency on the technology standards, and (5) to identify the percentage of teachers who met proficiency on the Virginia technology standards as of June 30, 2002.

The survey, *Methods Used to Determine Technology Competencies for Virginia Teachers* was administered in order to answer these five questions. The survey was developed and distributed electronically to division-wide technology directors across the Commonwealth of Virginia to determine which methods school divisions used to assess instructional personnel on the technology standards. The survey addressed the effectiveness and the cost efficiency of each method as perceived by the director of technology. The survey also addressed what incentives school divisions in Virginia offered to instructional personnel in order to meet proficiency on the technology standards. Additionally, the survey addressed the percentage of teachers who met proficiency on the technology standards.

CHAPTER IV

Findings

One hundred thirty-two surveys were electronically sent to directors of technology in every public school division in the Commonwealth of Virginia. The surveys were sent out December 11, 2002. The researcher resent the survey two weeks later when only 36 surveys were returned. After the second electronic mailing 10 surveys were returned immediately. The researcher then began calling or emailing the director of technology from the school's website to secure a valid email address. This process took time and sometimes two or more tries were necessary to locate the correct address. As a last effort the researcher emailed several superintendents and attached a copy of the survey in an effort to receive enough surveys to generalize results across the population. By April 2003, 104 surveys were collected from 132 sent, a 79% return rate; this was enough to generalize results across the population (Krejcie & Morgan, 1970).

Tables, figures and appendices captured both qualitative and quantitative data linked to the research questions. Quantitative data were entered into the Statistical Program for Social Studies (SPSS) software for analysis and to generate reports. Qualitative data were clustered around domains and reported in tables, and appendices. Organizing the data in this manner allowed the researcher to reflect upon the data and draw conclusions (Miles & Huberman, 1994).

This chapter reports the findings to five research questions captured by the survey, *Methods Used to Determine Technology Competencies for Virginia Teachers*. Those research questions were as follows:

1. What methods are school divisions in Virginia using to determine demonstrated proficiency on the technology licensure standards for teachers?
2. How effective is each method as perceived by the division's technology director?
3. Is the method cost efficient as perceived by the division's technology director?
4. What incentives are school divisions in Virginia offering to instructional personnel in order to meet demonstrated proficiency on the technology standards?
5. What is the percentage of teachers who met the technology standards as of June 30, 2002?

The researcher identified each research question and displayed the findings that correlated to each question. Tables and figures house the data along with narrative reporting.

Methods Virginia School Divisions Use to Determine Proficiency on the Technology Standards

This study sought responses to the question, *What methods are school divisions using across the Commonwealth to assess demonstrated proficiency on the state mandated technology standards?* The number and percent of surveys returned from the total population of 132 school divisions are listed in Table 2. According to Robert Krejcie and Daryle Morgan (1970), one needs 97 surveys returned from a population of 132 in order to generalize the results across the population with 95% (.05) confidence. Directors of technology from 104 school divisions returned their survey.

The number and the percent of school divisions that use or do not use the eight methods are shown in Table 2. *Workshops, college courses* and *mentoring* are clustered under the method *professional development.* Workshops, college courses, and portfolio assessment were the three most used methods to assess proficiency on the technology standards. Paper-pencil assessment was the least used method in public schools across the Commonwealth of Virginia.

Table 2

Frequency of Methods of Assessments Used to Determine Proficiency on the Technology Standards

Method	Used		Not Used		Total
	n	P	n	P	n
Computer based assessment	32	31.1	71	68.9	103
Performance assessment	52	50.5	51	49.5	103
Portfolio assessment	64	64.5	35	35.5	99
Paper-pencil assessment	16	16.0	84	84.0	100
Signed demonstrated proficiency statement	60	59.4	41	40.6	101
Professional development					
Workshops	81	83.5	16	16.5	97
College courses	73	73.0	27	27.0	100
Mentoring	43	47.8	47	52.2	90

Note. 104 surveys were returned, however some respondents did not check some methods. It may be that the respondent did not use the method so skipped it.

There were 5 methods (performance assessment, portfolio assessment, signed demonstrated performance, workshops and college courses) used in over 50% of the school divisions across the Commonwealth. The least used method was paper-pencil assessment. From the 100 school divisions responding to this question; only 16 school divisions used this method. These results demonstrate variability among school divisions on what methods to use to assess proficiency on the technology standards.

Multiple Methods Used to Assess Instructional Personnel

The number of school divisions that used one or more methods to assess instructional personnel on the technology standards is shown in Table 3.

Table 3

Frequency of Methods Used Per School Division in the Commonwealth

Methods Used	Number of School Divisions
1	9
2	14
3	13
4	28
5	17
6	13
7	10
8	0
	Total= 104

Note. 104 school divisions responded to this survey from a total of 132.

Nine school divisions used just one method to assess instructional personnel, and of those nine, portfolio assessment was the sole method used by four school divisions. There were 54 combinations among the eight methods that school divisions across the Commonwealth used to assess instructional personnel on the technology standards (See Appendix P). The most frequent method combination used was: *computer based assessment, performance assessment, portfolio* *assessment, workshops, college courses, mentoring and signed demonstrated proficiency statement*. Eight school divisions (7.6%) indicated that they used this combination of seven methods to assess instructional personnel on the technology standards. The next most frequent method combination used by five school divisions (4.8%) were four methods: p*ortfolio assessment, workshops, college courses, and signed demonstrated proficiency*. Another method combination used by five school divisions (4.8%) was six methods: *Performance assessment, portfolio assessment, workshops, college courses, mentoring and signed demonstrated proficiency statement.*

Responses to Open-Ended Items

Respondents gave a brief description of each method by answering the statement on the survey that asks them to describe the method. The descriptions in their entirety are listed by method in Appendices Q-U. A summary of these descriptions are categorized by the following methods: Computer based assessment, performance assessment, portfolio assessment, paper-pencil assessment, and professional development which encompasses three methods: workshops, college courses and mentoring.

Computer based assessment. Computer based assessment was the first of eight methods listed on the survey. If the respondent clicked on the radio button that indicated the school division used the computer based assessment then the respondent was asked to *Briefly describe the computer-based method in the write-in box below.* These descriptions were summarized and clustered around five domains: *Test format*, *Medium used*, *Location*, *Standards or skills tested* and *If one fails* as shown in Table 4. A complete list of descriptive responses on the computer based assessment method (stated in context) is found in Appendix Q.

Table 4

Respondent's Descriptions of Computer Based Assessment

Domain	Description
Test format	Multiple choice (3)
	Essay questions
	True and false questions/statements
	Combination of all three above
Medium used	Web Quest
	Act Now
	Blackboard (3)
	Accelerated Reader/math
Location	Central office
	Individual school sites
	Local community college (2)
Standards or skills tested	Standards A (demonstrate effective use of computer system and utilize computer software); B (terminology); C (apply computer productivity tools); and D (use electronic technologies to access and exchange information)
	Various standards
	Terminology/vocabulary (3)
	Standard B (terminology) and H (demonstrate knowledge of ethical and legal issues relating to the use of technology)
	Microsoft Office Suite, word processing
	Test divided into three sections that address technology standards
If one fails	Use another method such as signed demonstrative proficiency statement
	Provide professional development
	Retake only the section one fails

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also, each respondent may have multiple responses per domain.

The descriptions varied within the computer assessment domains. For example, instructional personnel took the computer-based assessment at central office and still other school divisions offered the assessment at individual school sites or at the local community college. The skills or the standards tested using the computer- based assessment varied greatly. Some school divisions used the computer assessment method only to test vocabulary; others assessed proficiency by assessing a program such as *Microsoft Office Suite* and still others assessed specific technology standards.

Performance assessment. Performance assessment was the second of eight methods listed on the survey and defined on the survey as; *The individual produces assignments specified by the school division on the computer and sends it electronically to a designated place or teachers are asked to perform several specified tasks on the computer.* If the respondents clicked on the button that indicated their school division uses the performance assessment, then they were asked to, *Briefly describe the performance assessment method on the computer in the write in box below.* These descriptions were summarized in Table 5 and clustered around the following domains: *Performance tasks*, *Supervised*, and *If one fails.* A complete list of descriptive responses on the performance assessment method (stated in context) is found in Appendix R.

One school division required instructional personnel to create

> a simple word processing document, a simple spreadsheet and a simple database. . . .This plan for technology competency was created to be simple since so many teachers have hardware with limited capability. Teachers cannot be asked to do something for which they do not have the tools to do it. (Appendix R, third bullet)

Table 5

Respondent's Descriptions of Performance Assessment Method

Domain	Description
Performance tasks	Spreadsheet (9)
	Varied assignment tasks (9)
	Database (8)
	Word processing (8)
	Develop a PowerPoint presentation (5)
	Create and send email (5)
	Complete a project (4)
	Send email with attachments (4)
	Create an SOL lesson plan that incorporates technology and post to web site (2)
	Evaluate software (2)
	Print out something (2)
	Create a Web page
	Demonstrate use of CD Rom
	Demonstrate use of floppy disk
	Evaluate web sites
	Insert graphic
	Make a video of the teacher using technology with her students
Supervised	By an administrator/coordinator (8)
	Submit to administrator or designee (8)
If one fails	Retake a class and then demonstrate proficiency by completing a project

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. The number of responses may not match the number of respondents who indicated their school division uses this method (See Table 2) because not all respondents described their method in the write-in box on the survey. Also, respondents may have multiple responses per domain.

Another school division required a project that entailed setting up a data base, designing brochures, evaluating software packages, and producing a PowerPoint presentation all in the presence of a technology coordinator. Nine school divisions did not describe any specific tasks, just to say they had their instructional personnel do several varied tasks. Of those who responded to supervision, 50% stated the performed task(s) was directly supervised by an administrator or coordinator and 50% stated the performed tasks were completed and then given to an administrator.

Portfolio assessment. Portfolio assessment was defined on the survey as T*he individual produces assignments specified by the school division on the computer, prints it out, and keeps it in a notebook or submits a disk to the appropriate school official.* If the respondents indicated that their school division used this method then they were asked to give a brief description of the method. The portfolio assessment descriptions were summarized and clustered into the following domains: *Assignments to be included in the portfolio*; *Evaluated by*; and *Submitted in the form of* in Table 6. A complete list of descriptive responses on the portfolio assessment method (stated in context) is found in Appendix S.

The most popular description (33.%) under the domain of assignments given in the portfolio method was creating tasks such as: a word processing document, a spreadsheet, and a database, locating a resource on the network or the internet, create a word publishing document, send email out to a group, etc. The next highest response (16%) was to provide documentation of meeting the standards (See Table 6).

Table 6

Respondent's Descriptions of Portfolio Assessment Method

Domain	Description
Assignments to be included in the portfolio	Several tasks such as: create a word processing document, a spreadsheet, and a database, locating a resource on the network or the internet, create a word publishing document, send email out to a group, etc. (21)
	Provide documentation of meeting the standards (10)
	A Final Project such as a technology enhanced lesson plan or other products such as a creating a Web page, a Power Point presentation, spreadsheets, and or data base (5)
	Two-four assignments that cover 8 standards (4)
	Series of skills checklist covering 4 standards; two lesson plans covering 4 standards and 4 additional assignments
	Two lesson plans using technology plus 6 other assignments
	Tiered assignments-simple to complex
	Computer based assessment given on terms and printed out to be included in portfolio
Evaluated by	Administrator/designee (5)
	Technology employee (5)
	Administrator or designee using a rubric (2)
	Initialed by a witness (peer, instructor or administrator)
	Self
	An individual who is TSIP proficient
	Teacher's licensure advisor or designee
	Proper personnel
	Teacher committee
Submitted in the form of	Hard copy printed out and placed in notebook or folder (10)
	Disk (7), Electronic folder (3), Email (2)

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. TSIP= technology standards for instructional personnel. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also respondents may have multiple responses per domain

The most popular way to evaluate the portfolio assessment was by the administrator or an employee who works in the technology department.

Paper pencil assessment. The paper pencil assessment was defined on the survey as, T*he individual responds to specified items by the school division on paper using a pencil.* If the respondents indicated that their school division used this method then they were asked to give a brief description of the method. The paper pencil assessment descriptions were summarized and clustered into two domains: *Standards or skills tested*, and *Format use* as shown in Table 7. Additionally, two more questions on validity and reliability were posed to the 16 respondents who indicated that they use the paper pencil method. Their responses are shown in Table 8. A complete list of descriptive responses on the paper pencil assessment method (stated in context) is found in Appendix T.

The paper pencil assessment was primarily used (56% of those responding to the survey) to meet the Technology Standard B*; Instructional personnel shall be able to apply knowledge of terms associated with educational computing and technology* ([see Appendix A] Virginia Department of Education [VDOE], 1998b). The paper pencil assessment was given in multiple-choice format by 19% of those responding to the survey. Since all other respondents did not allude to the format, one cannot determine if essay questions or open-ended statements were used. Additionally, most of the respondents using the paper pencil assessment did not test the instrument for validity or reliability.

Table 7

Respondent's Description of Paper Pencil Assessment Method

Standards or skills tested	Terminology (9)
	Ethics/legal issues (2)
	Basic knowledge/concepts (2)
	Internet use
	Basic troubleshooting
Format used	Multiple choice (3)

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also, respondents may have multiple responses per domain.

Table 8

Responses to Validity and Reliability of Paper Pencil Assessment Method

	Paper/Pencil Tested for Validity?		Paper/Pencil Tested for Reliability?	
Response	n	P	n	P
No	13	81.3	14	87.5
Yes	3	18.7	2	12.5

Professional Development

The method, professional development was divided into three categories on the survey; *workshops, college courses and mentoring*. Respondents described what type of professional development was used in their school division (See Appendix U). Survey results indicated professional development, specifically workshops (84%) and college courses (73%) as the most often used methods of assessing instructional personnel across the Commonwealth (See Table 2).

Workshops. There were two types of data that capture the qualitative responses on workshops. The descriptive data were clustered into two domains: (a) *Standards or skills tested,* and (b)*When workshops were held*. These data are shown in Table 9. The number of hours and sessions varied significantly as reported qualitatively by school divisions throughout the Commonwealth of Virginia. Each respondent's description of the workshop in hours and/or in number of sessions are reported in Appendix U.

The workshops covered skills, specific software programs, *Technology Standards A through E* ([see Appendix A] Virginia Department of Education [VDOE], 1998b).and topics of general interest. One respondent specifically reported integrating technology into instruction as the focus of their workshop. Additionally, two survey respondents reported that grant monies were used to support workshops. One respondent indicated that their school division used grant monies to pay teachers to attend the summer sessions and trainers to train teachers after school. . Another respondent indicated that the school division provided a large number of staff development opportunities due to the technology challenge grant funds and local funds. A complete list of respondents' descriptions for professional development-workshops (stated in context) is shown in Appendix U.

Table 9

Respondents Description of Workshops

Domain	Description	
Standards or skills tested	Skills (4)	Topic (4)
	PowerPoint (3)	Standards A-E (3)
	Digital camera (2)	Data bases (2)
	MS Word (2)	Access
	Criteria	Excel
	Grade Quick	GroupWise
	SASI	Integrating technology into instruction
	Specific task	Technology issues
When workshops were held	After school (10)	
	Summertime (6)	
	Inservice days (3)	
	Pre service week (2)	
	[a]During the school day	

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. [a] Substitute coverage was offered when workshops were held during the day. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also, respondents may have multiple responses per domain.

College Courses. College courses were listed as the second category under the method, *professional* d*evelopment* on the survey. The descriptions given for college courses are summarized and clustered into the following domains; C*olleges*, *College credit earned*, and *Course name/Skills taught* as shown in Table 10. A complete list of descriptive responses for professional development- college courses method (stated in context) is shown in Appendix U.

College courses were the second most frequently used method (73%) to assess proficiency of instructional personnel on the technology standards. More respondents named a community college than a four-year college for courses that met proficiency requirements on the technology standards. One-and three-college credits were almost equally accepted. More survey responses indicated that college courses addressed all eight-technology standards (See Appendix U). Two respondents identified advance technology use was covered in college courses.

Mentoring. Mentoring was the third category under the method, professional development. Fewer respondents acknowledged this category under professional development with 90 survey responses as compared to workshops and courses with 97 and 100 responses respectively. The descriptions given for mentoring are summarized into the following domains: *Who provides the mentoring; To whom receives the mentoring; When does the mentoring take place, What kind of support is given, Stipends or grants offered, and How long is the mentoring* as shown in Table 11. A complete list of descriptive responses for professional development-mentoring method (stated in context) is shown in Appendix U.

Table 10

Respondent's Descriptions of College Courses

Domains	Descriptions
Colleges	Local community college (10)
	Four year college/university (5)
	College course online (2)
College credit earned	One college credit (14)
	Three college credits (16)
College name/skills taught	All 8 technology standards (6)
	Introduction to technology (4)
	Advanced use of technology (2)
	Use of technology in instruction (2)
	Computer Applications for teachers
	Internet in the classroom
	Technology certification classes

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also, respondents may have multiple responses per domain.

According to the survey responses, staff in the technology department or technology proficient teachers equally mentored instructional personnel. Personnel who were mentored varied across the Commonwealth. Some school divisions mentored teachers new to the division, others mentored teachers not technologically savvy, and then some mentored all teachers in their school division.

Table 11

Respondent's Descriptions of Mentoring

Domain	Description
Who provides the mentoring	Technology staff (11)
	Proficient teachers (11)
To whom receives the mentoring	Mentoring is provided to new teachers (3)
	Mentoring is dependent upon the new staff's ability and needs
	Teachers who are not technology savvy
	All teachers
When does the mentoring take place	After school (2)
	One night per month
	During the school day
What kind of support is given	Instructional support (3)
	Support to meet proficiency on the technology standards (2)
	Telephone and online support (2)
	Many areas (2)
Stipends or grants offered	Stipends (4)
How long is the mentoring	Three years

Note. Values enclosed in parentheses indicate the number of respondents who gave the same description. All other descriptions represent one respondent. The number of responses may not match the number of respondents who indicated their school division uses this method (Table 2) because not all respondents described their method in the write-in box on the survey. Also, respondents may have multiple responses per domain.

Mentors provided instructional support; some mentors were offered support through the computer-online and other school divisions offered support via the telephone. Four school divisions reported that mentors received stipends, although no specific amount was reported.

Effectiveness of Methods

Survey respondents were asked to grade the effectiveness of each method given a Likert scale of *A, B, C, D, or F*; *A* indicating extremely effective and *F* indicating extremely ineffective. The number and percent of school divisions grading the effectiveness of each method are shown in Table 12. Additionally, another question on the survey asked the respondent, *If you graded the effectiveness of your school division's method a C or below, please identify the method and then specify how this method could be better.* The respondents' suggestions were grouped by method and placed in Appendix V.

The most effective methods were workshops with a mean of 4.29; mentoring (4.21); performance assessment (4.20) and college courses(4.20) were the next most effective. The least effective method was computer-based assessment with a mean of 3.91 followed closely by paper-pencil assessment (3.95). Performance assessment had the least dispersion among the methods with a standard deviation of .67. and signed demonstrated proficiency statement had the largest dispersion of responses with a standard deviation of .95. Another way to view the data is to examine the percent of *A's* and *B's* as shown in Table 13. Workshops had the largest percent of *A's* (46%) followed by college courses (39%) and then mentoring (38%). Portfolio assessment received 26% *A's* even though it was rated as the third most popular method used to assess proficiency on the technology standards.

Table 12

Reported Effectiveness of Methods Used in School Divisions Across the Commonwealth

Methods	n %	A	B	C	D	F	Total	*M*	*SD*
Computer based assessment	n %	8 22.9	18 51.4	7 20.0	2 5.7		35	3.91	.82
Performance assessment	n %	19 33.9	29 51.8	8 14.3			56	4.20	.67
Portfolio assessment	n %	17 26.6	35 54.7	9 14.0	3 4.7		64	4.03	.78
Paper-pencil assessment	n %	5 26.3	9 47.4	4 21.0	1 5.3		19	3.95	.85
Signed demonstrated proficiency statement	n %	22 37.3	23 39.0	10 16.9	3 5.1	1 1.7	59	4.05	.95
Prof. development workshops	n %	38 46.3	31 37.8	12 14.6	1 1.3		82	4.29	.76
Prof. development college courses	n %	29 39.2	33 44.6	10 13.5	2 2.7		74	4.20	.78
Prof. development mentoring	n %	18 38.3	22 46.8	6 12.8	1 2.1		47	4.21	.75

Note. The total numbers may not match those numbers in Table 2 because some respondents who indicated they did not use the method in their school division, went on to grade the effectiveness of the method shown here in Table 12.

Paper-pencil assessment received the largest percent of *C's* and *D's* (26%) and computer-based assessment followed with 25%. Signed demonstrated proficiency statement was the only method that received an *F* by one school division. One respondent suggested that paper pencil and the portfolio assessment could be improved by ensuring there was “uniformity from coordinator to coordinator and school to school”(Appendix V, # 4).

Table 13

Methods Ranked High to Low by Perceived Effectiveness

Method	Percent of A’s and B’s
Performance assessment	85.7
Professional development mentoring	85.1
Professional development workshops	84.1
Professional development college courses	83.6
Portfolio assessment	81.3
Signed demonstrated proficiency statement	76.3
Computer based assessment	74.3
Paper pencil assessment	73.7

Five methods receive 81-86 % *A’s* and *B’s* on effectiveness. When the effectiveness of each method by combining the percentage of *A’s* and *B’s* was considered, performance assessment and mentoring rate first and second in effectiveness. Yet, when examining methods with the highest percent of *A’s* alone four other methods rated higher than performance assessment. These findings demonstrated a high rate of dispersion among most of the methods.

Descriptive Comments on Effectiveness of Method

In addition to grading the effectiveness of each method, directors of technology or their designee was asked to specify how their method could be better if they graded it a *C* or below.

One respondent suggested that the computer based assessment process was good, but they questioned if this assessment accurately assessed the teacher's understanding of how to use technology. Another concern was that this was a one-time assessment, there was no assurance that one would continue to grow technologically.

Another respondent specified that the performance assessment method could be improved if more funds for more technology specialists and release time for evaluators were provided; still another complained that the old equipment was lacking to the degree it did not support what the new assessment was requiring one to do. (This respondent did not allude to what task that was). One suggestion that seemed to be emulated across several methods such as professional development, portfolio and signed demonstrated proficiency statement was to train administrators better to evaluate proficiency on the technology standards. In the words of one respondent, "Problems here are having principals KNOW what it is they are looking for! That has been the focus of administrative staff development this year"(Appendix V, # 6). One commented that their school had an evaluator, but this person served 5 schools, therefore evaluations had to be completed after the regular teaching day. This respondent suggested more funds would allow them to hire more technology specialists to help evaluate and thus be more effective.

The professional development method of workshops was used most across the Commonwealth of Virginia, yet some expressed ways to improve this method. Two respondents suggested that attendance be mandatory and another suggested that the method tended to be *boring* and it should be more of a *hands-on* process. Still another respondent seemed to look at the big picture when stated,

> I would like to see initial technology training at a central location with a greater focus on integration of tech. with instruction . . . .Cost would be location for training (school lab/division lab) release of teachers for training, site person or Instructional Technology person with an understanding of curriculum and instructional design.(Appendix V. #5)

A complete list of comments to improve methods graded a *C* or below is shown in Appendix V.

Cost Efficiency of Methods

Cost efficiency was determined by the number and percent of respondents who indicated, *Yes* or *No* on the survey. Respondents were asked, *Is this method cost efficient?* on the survey. Respondents indicated, *Yes* or *No* by clicking in the respective radio button on the electronic survey. Responses to the question, *Is this method cost efficient?* are shown in Table 14.

Portfolio assessment received the largest percentage (95%) of affirmative responses on cost efficiency. The two methods that received the lowest percentage of affirmative responses were paper pencil and college courses with 73% and 75% respectively. Six of the eight methods were reported to be cost efficient by 80% or more of the survey respondents.

Incentives Offered to Instructional Personnel

The researcher wanted to know what incentives, if any, were offered to instructional personnel across the Commonwealth of Virginia who met proficiency on the technology standards. Respondents were asked to check incentives listed on the survey that were used in their school division or to write in other incentives not listed on the survey. There were 104 surveys returned. Respondents indicated whether their school division used the following incentives: re-licensure points, laptop computer, one-time monetary stipend, certificate, plaque, banner, and/or name identified in the school paper by electronically clicking on the radio button next to the incentive listed. Respondents could check more than one incentive.

Table 14

Reported Cost Efficient Method Used to Assess Technology Proficiency of Instructional Personnel

Method	n %	Yes	No	Total
Cost efficient computer based assessment	n %	32 86.5	5 13.5	37
Cost efficient performance assessment	n %	48 90.6	5 9.4	53
Cost efficient portfolio assessment	n %	60 95.2	3 4.8	63
Cost efficient paper-pencil assessment	n %	11 73.3	4 26.7	15
Cost efficient signed demonstrated proficiency statement	n %	47 92.2	4 7.8	51
Cost efficient professional development-workshops	n %	71 91.0	7 9.0	78
Cost efficient professional development-college courses	n %	53 75.7	17 24.3	70
Cost efficient professional development-mentoring	n %	42 91.3	4 8.7	46

Note. The total numbers may not match those numbers in Table 2 because some respondents who indicated they did not use the method in their school division, went on to indicate cost efficiency of the method shown here in Table 14. Also, some respondents who indicated they used the method (See Table 2) did not choose to answer the question on cost efficiency.

Their response was linked to a database that calculated the frequency of responses for each incentive listed. Additionally, the respondent could identify *other types of incentives, please* *specify,* and a write-in box was provided for the respondent. The incentives used in school divisions across the Commonwealth of Virginia are shown in Table 15.

Table 15

Incentives Offered to Instructional Personnel for Meeting Proficiency on the Technology Standards

Number of School Divisions	Incentives Offered
75	Relicensure points
59	Certificates
9	One-time monetary stipend
7	Lap-top computers
2	Name identified in school paper
1	Plaque
1	Banner
Number of Responses	**Write-In Incentives**
5	Pre-paid college classes
4	No funds for incentives
3	The staff member may get their license renewed
2	Staff development points/ recertification points
2	This is part of the evaluation expectation
2	Recognition by the school board
1	Opt out time from teaching equal to the chair time for training
1	One will incur a gross salary freeze if staff does not meet requirements
1	Desktop computer in the classroom
1	Teachers who do not meet proficiency by July 1, 2003 will be placed on a formal improvement plan
1	We provide a $500.00 stipend to our secretaries for passing the competencies
1	Workdays were set aside for this work
1	Must complete portfolio to continue employment
1	We are more interested in improving instruction. Those teachers who are going beyond email and Word are given opportunities for more workshops and training that often does involve stipends, laptops, or other incentives. We are not offering much in the way of incentives for meeting basic standards.
1	General recognition
1	Receives assignment appropriate software
1	Opportunity to teach classes for pay
1	A TSIP pin is given to those who pass

There were 96 returned surveys that had at least one incentive checked or listed. One additional survey entered *N/A* for incentives for a total of 97 survey respondents that answered this question. Seven other surveys were returned with nothing checked for incentives.

The two incentives most often used among school divisions across the Commonwealth of Virginia are re-licensure points and certificates. Plaques and banners were the least used. There were 18 other write-in incentives some of these incentives were indicative of sanctions. For example, one school division stated that the teacher would incur a salary freeze if they did not meet requirements; another school division reported that teachers would be placed on a formal improvement plan if they did not meet proficiency. The complete list of incentives is shown in Table 15.

Percent of Teachers Meeting Proficiency on the Technology Standards

The question on the survey aligned with the last research question for this study asked, *What percent of your teachers have met proficiency on the technology standards as determined by the Virginia Department of Education as of June 30, 2002?* The researcher identified the number of school divisions that reported the percentage of teachers who met proficiency on the technology standards. The results are shown in Figure 2.

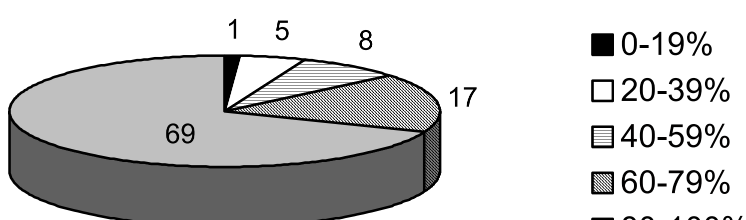

Figure 2. Number of school divisions report, in the designated percentage ranges, the number of teachers demonstrating proficiency on the technology standards as of June 30, 2002.

Responses to the question, *What percent of your teachers have met proficiency on the technology standards as determined by the Virginia Department of Education as of June 30, 2002?* were received from 100 school divisions. According to the results, 69 of the100 responding Virginia public school divisions reported that 80-100% of their teachers had met proficiency on the technology standards. Likewise, 31 school divisions in the Commonwealth of Virginia reported that less than 80% of their teachers had met proficiency on the technology standards. Eight of those 31 school divisions reported that less than 50% of their teachers had met proficiency on the technology standards.

Chapter Summary

Data collected from the survey, *Methods Used to Determine Technology Competencies for Virginia Teachers* rendered the following results. School divisions across the Commonwealth of Virginia used several methods to assess instructional personnel on the technology standards. From the 104 school divisions that responded, the three most popular methods used was workshops (84%), college courses (73%), and portfolio assessment (65%). Most school divisions used more than one method. There were 54 eight-method combinations used throughout the Commonwealth of Virginia. This fact alone reveals the variability across school divisions. Twenty-eight school divisions used 4 methods; yet only 5 out of 28 school divisions used the same four methods. Only nine school divisions used one method, yet four of those nine school divisions used the same method. The respondent's descriptions to the three most popular methods, workshops, college courses and portfolio assessment varied significantly. There was no consistency across school divisions regarding which combination of methods were used.

The effectiveness of the methods were graded by school divisions on a scale of *A, B, C, D, or F; A* indicating extremely effective and *F* indicating extremely ineffective. All eight methods were rated a *B* by most school divisions in Virginia with the exception of workshops. Workshops received the highest percentage (46.3%) of *A's.* Among all eight methods, computer-based and paper-pencil assessment received the greatest number of *C* and *D* ratings (26%). Signed demonstrated proficiency statement received one *F*, three *D's* and 10 *C'*s from 24% of the school divisions across the Commonwealth of Virginia.

The cost efficiency of each method was measured by the number and percent of respondents who indicated, *Yes* or *No* to the question on the survey, *Is this method cost efficient?* All eight methods received affirmative ratings by a majority of school divisions in the Commonwealth of Virginia. The paper-pencil assessment was rated at the lowest end (73%) and portfolio assessment received the highest affirmative rating of 95 %.

Incentives were offered in most school divisions. The most popular incentive was relicensure points; 75 school divisions checked this option. The next popular incentive offered to instructional personnel was certificates; 59 school divisions checked this option. Nine school divisions offered a one-time monetary stipend and seven school divisions offered a laptop computer. There were 18 write-in incentives, but no more than five school divisions wrote in the same incentive. Some respondents reported sanctions versus incentives such as: *One will incur a gross salary freeze if staff does not meet requirements* and *Must complete portfolio to continue employment* (Table 15).

On July 1, 2003 all instructional personnel in the Commonwealth of Virginia had to be proficient on the technology standards. As of June 30, 2002- one year before schools were required by the VDOE to have all teachers proficient on the technology standards, more than half (66%) of the school divisions report 80-100% of their instructional personnel meeting proficiency on the technology standards. Eight school divisions reported that less than 50% of their instructional personnel had met proficiency on the technology standards. It is important for one to remember what proficient means when reflecting on the above results. The VDOE defines proficiency as "A demonstrated level of competence of the technology standards as determined by school administrators"(Technology Standards for Instructional Personnel [see Appendix A] Virginia Department of Education, 1998b, p. 1). According to the write in descriptions on how to improve the effectiveness of methods several respondents questioned the competency level of the school administrators or their designee to evaluate proficiency. This thought along with others are discussed in Chapter V.

CHAPTER V

Discussion, Recommendations and Future Avenues of Research

The Commonwealth of Virginia requires public school instructional personnel to demonstrate proficiency on the eight technology standards mandated by the Virginia Department of Education (VDOE) through §22.1-16 of the *Code of Virginia* ([see Appendix A] Virginia Department of Education, 1998b). The VDOE mandated Virginia public schools to ensure that instructional personnel are proficient in these eight technology standards by July 1, 2003. Those who held a valid teaching license prior to 2002-2003 must provide documentation that they met proficiency on the technology standards by the expiration date of their license. Otherwise, they will be denied continued licensure.

No direction was given to school divisions on how to provide staff development or assess demonstrated proficiency on the eight technology standards. The *Code of Virginia* defines *demonstrated proficiency* of technology standards as “A demonstrated level of competence of the technology standards as determined by school administrators”(Technology Standards for Instructional Personnel [see Appendix A] VDOE, 1998b, p. 1). Currently, no statewide standard assessment exists, and no systematic measurement of proficiency is provided by the VDOE. There are 132 public school divisions in the Commonwealth of Virginia that have established their own standard of proficiency.

My research questions were as follows:

1. What methods were school divisions in Virginia using to determine demonstrated proficiency on the technology licensure standards for teachers?

2. How effective was each method as perceived by the division's technology director?
3. Was the method cost efficient as perceived by the division's technology director?
4. What incentives were school divisions in Virginia offering to instructional personnel in order to meet demonstrated proficiency on the technology standards?
5. What was the percentage of teachers who met the technology standards as of June 30, 2002?

Results from this study demonstrated that a wide-range of methods was used to assess instructional personnel on the technology standards. The results are summarized and discussed according to the order of the research questions beginning with the methods that are used across the Commonwealth of Virginia.

Methods Used

Most school divisions provided workshops and college courses (83% and 73% respectively) as a method of assessing instructional personnel on the technology standards. Paper-pencil assessment was the least used method (16%) by school divisions. Most school divisions used more than one method to assess instructional personnel. The combination of methods used was interesting. There were 54 separate method combinations. No consistent patterns were found. For example, 28 school divisions reported using four methods; yet there were 16 different four-method combinations reported. Even the most used method combination was administered by only 7.6% of the school divisions (8 school divisions) and that was a seven-method combination. One possible explanation for multiple method combinations is that school administrator's technological ability varies from one school to the next and their level of proficiency influences the method used in their school to assess proficiency on the technology standards.

Method Descriptions Vary From One School Division to the Next

The descriptions of each method given by school systems varied from one school division to another. There was not consensus among school divisions on the method used to assess proficiency on the technology standards. For instance, workshops, the topics varied from general skills taught to focused lessons on PowerPoint, or Microsoft Word, or GroupWise (email). Still other school divisions used workshops to teach instructional personnel how to integrate technology in the classroom. The time spent in workshops varied from 30 minutes to 90 hours. Sessions also varied from one to 30 sessions. Even so, one school division identified workshops and attendance at workshops as meeting proficiency on the technology standards.

According to the method descriptions, it is evident that instructional personnel in some school divisions met proficiency with less effort than other school divisions. For example, instructional personnel in some school divisions are directly supervised while they perform tasks specific to the standards, which included lessons that integrated technology in the classrooms. Unless one is supervised while taking the assessment or performing the tasks, doubts exist to whether or not instructional personnel received help on the assignment. One comment on the survey spoke to this concern by reporting a situation where the Power Point presentation was actually designed by a student. Then there were school divisions that held instructional personnel to higher standards. Another respondent described the method of assessment in his school division as giving written tests on:

> vocabulary, parts of computers, ethical issues, legal issues, etc. However, the second part of the assessment is performance based, and it requires practical applications, including

setting up databases, designing brochures, evaluating software packages, formatting disks, preparing PowerPoint presentations, etc. These practical applications take place in the testing center with a technology coordinator evaluating work.(Appendix Q, the ninth bullet)

The information gathered on methods of assessment in this study would be of interest to the VDOE (2003) as stated in the *Educational Technology Plan for Virginia 2003-2009,* whereby it wants the department to identify school divisions that have a good assessment tool in place and share its design with other school divisions. School divisions in the Commonwealth used a combination of eight methods, yet no two school divisions looked alike. Even those school divisions that used the same methods varied the materials used or the performance tasks that were taught. Neither is the expectation of instructional personnel similar from one school division to the next. Some school systems asked very little of their instructional personnel technologically while other school divisions appeared to assess all the standards. It is my recommendation that those school divisions that assessed all the technology standards share their assessment instruments with other school divisions.

Effective teachers use assessment data to drive instruction. Likewise, the VDOE should look at this report and perhaps other studies (for example, Hoover, 1997) and develop a standardized assessment that school divisions in the Commonwealth could administer. Gloucester County Schools provided a comprehensive assessment of performance tasks, portfolio, paper-pencil and staff development. In Hoover's study, technology standards and the requirements that instructional personnel needed to meet the standards were specifically stated. For some standards, choices were given, but even then the options were specified. A follow-up to this study might be assessing the degree of integrating technology across the curriculum. Is the assessment of technology standards enough to see the use of technology carried over to the classroom?

Perceived Effectiveness of Methods

When I viewed this data, I observed that all methods were graded an *A* and a *B* by 70% or more of the school divisions. One possible reason for this high score could be that the person most likely completing the survey was also the person who designed the method or approved it for assessing instructional personnel. Next, I viewed comments respondents gave to improve their method given a *C* or below. Several comments indicated a lack of personnel or competent evaluators contributed to the weakness of their method. One stated it was another checklist and another stated they only gave lip service to new regulations that teachers were not mandated to attend workshops. And still another respondent stated, "until I came to the district. They pretty much signed off on anything the teachers did."(Appendix V, #5 professional development; college courses). These comments suggest that even though a large percentage of instructional personnel have met proficiency as reported in this study, the competence of some evaluators is questionable. If evaluators are not technologically competent then it is logical to question the technological competence of teachers being evaluated. Perhaps policies are needed that ensure evaluators are certified to meet specific technology standards. The International Technology Education Association (ITEA, 2003) strongly encourages schools across the country to embrace its standards of technological literacy for students, teachers and administrators.

Perceived Cost Efficiency of Methods

Respondents indicated that portfolio assessment is the most cost efficient method (95%), the least cost efficient method was paper-pencil (73%). I was curious to why paper pencil was rated the least cost efficient. One respondent stated that the local college produced the assessment; perhaps this was costly, though the comment did not speak to the cost of this service. Several respondents spoke of a multiple-choice format and that paper-pencil assessment was used for only a portion of the assessment, mostly terminology. Since a majority of respondents indicated they did not test for validity (81%) or reliability (87.5%), that would not be an expense factor. Then again, only 16 school divisions in the Commonwealth used this method and three of them did test for validity and two tested for reliability. Perhaps there was some cost to this testing, although no comment alluded to the expense of validity or reliability testing. Perhaps the cost was related to personnel and the time it takes to score the assessments. One respondent concerned about the cost of the computer based assessment complained, "Not cost effective because our license to Blackboard is $5000 per year" (Appendix Q, 21st bullet). After reading that I wondered why computer based assessment was not the least cost efficient.

College courses rated a close second (75.7%) to being the least cost efficient assessment. The cost of a 3-credit college course today is $400.00 or more. Some school divisions have partnered with universities and local colleges to keep the cost down. Other school divisions offered more than one method to assess instructional personnel and a college course was one option for them. Five school divisions paid for the college course as an incentive for instructional personnel to meet proficiency on the technology standards.

Incentives

Re-licensure points and a certificate seemed to be the most frequently used incentives. Four responses indicated they had no funds for incentives and seven surveys were returned with nothing checked or written in for incentives. Most likely their school division did not offer incentives. Some respondents wrote sanctions versus incentives to what would happen if teachers did not meet proficiency. One respondent wrote,

> We are more interested in improving instruction. Those teachers who are going beyond email and Word are given opportunities for more workshops and training that often does involve stipends, laptops, or other incentives. We are not offering much in the way of incentives for meeting basic standards.(Table 15, Write-In Incentives)

Several respondents indicated that meeting proficiency on the technology standards is a basic expectation of one's instructional position; therefore, the renewal of one's teaching license should be *the* incentive.

Percent of Teachers Passing

The large percentage of teachers reported meeting proficiency on local school division's methods across the Commonwealth surprised me. However, after careful review of the write-in method descriptions and reviewing respondent's concern of the administrator's ability to evaluate teacher proficiency, it was evident *proficiency* is not clearly understood. If it is up to the school administrator, as stated in the current VDOE regulation, then the definition is weak and we have 132 different interpretations of proficiency. Furthermore, the VDOE established eight technology standards and local school divisions have interpreted these eight standards 132 different ways.

Recommendations

There are 132 school divisions in the Commonwealth of Virginia. Although all school divisions have the same technology standards for instructional personnel, the standards are interpreted differently across Virginia's public schools. The fact is these standards are linked to licensure; therefore the degree to which one interprets these standards and the way one is evaluated on these standards matters significantly. There is potential for litigation if one is denied licensure due to not meeting proficiency as determined by the school administrator. It would be hard for school divisions to defend inconsistent standards of measuring proficiency and or inconsistent assessment practices. Therefore, I would like to submit the following recommendations based on this study:

1. The VDOE should provide a standardized assessment that sufficiently assesses instructional personnel on the Virginia technology standards. This recommendation is consistent with the findings of Mann et al. (1999), whose study suggested the longer students are exposed to computers, software programs that address academics, and better attitudes about computers, the higher the gain scores are on the Stanford-9. Sanders and Horn (1997) reported the most important factor related to student achievement is the teacher. The content knowledge and skills teachers bring to the classroom have a direct impact on student performance.

2. The VDOE should be clear on who should evaluate instructional personnel on the technology standards; at a very minimum the administrator evaluating *proficiency* should have to meet proficiency on the technology standards prior to becoming an assessor. According to Dewert (1999) more states are requiring pre-service teachers to meet technology-related requirements to receive their initial teaching license. Dewert also reported fewer states require administrators to meet technology-related requirements. Administrators should be held to at least the same standards and be evaluated at the same level as teachers on their technology proficiency. Cooley (1998) purported training teachers and principals on the use of computers and how to use them to enhance instruction. Additionally, the *Educational Technology Plan for Virginia 2003-2009* stated that teachers need adequate support from school leaders to successfully integrate

technology throughout the curriculum. Holland and Moore-Steward (as cited in VDOE, 2003) stressed the importance of the building principal's support. The principal should be able to recognize and evaluate effective technology use in the classroom, in order to improve teacher's skills.

3. The VDOE should review the findings of this study to understand the discrepancy in the design of methods; how directors of technology rated effectiveness and cost efficiency; and especially how the directors would improve the methods of assessing instructional personnel on the technology standards throughout the Commonwealth. This recommendation is consistent with Hawkins et al. research (1996). They identified school sites that were technologically advanced and determined key features that contributed to the successful reform. Additionally, the 2*003-2009 Educational Technology Plan for Virginia* suggested that the VDOE identify and assess the models that have been developed and share these models with school divisions in the Commonwealth. This study could have implications for policy and be of value as they design an assessment that correlates to the technology standards.

4. The VDOE should identify school divisions that effectively assessed all eight-technology standards and share the assessment instrument with other school divisions in the Commonwealth. Hoover's study (1997) influenced this recommendation because his school division effectively assessed each technology standard. Hoover took a comprehensive approach to providing staff development in the area of technology. In addition to training, he required the teacher to submit samples of student work indicative of technology integrated into instruction.

Recommendations for Future Avenues of Research

This study has implications for additional research. Other topics related to this study and worthy of research are as follows:

1. This study surveyed directors of technology, but perhaps it would be interesting to know how building administrators would respond to the same questions. Building administrators are closer to the instructional environment. It would be interesting to note the similarities and differences in their responses. Building administrators may add much to the question, *How would you improve this method of assessment?*

2. Another study might investigate the perceptions of teachers by administering the same survey given to directors of technology. Perhaps asking teachers one more question, *Did the method of assessing your performance accurately measure your technological ability?*

3. Standards are needed to hold instructional personnel to some degree of accountability. Organizations have outlined technology standards that will promote technological literacy for students, teachers and administrators. It would be helpful if a study were conducted to determine to what extent *Virginia's Technology Plan 2003-2009* is aligned to ISTE, NETS, and ITEA. Bartley (2001) influenced this recommendation by examining the Virginia technology standards and making recommendations to revise the language respective to level of training, i.e. elementary teacher's perspective versus secondary teacher's perspective.

4. Some states do not have state mandated technology standards for teacher licensure; they expect college teacher preparation programs to train teachers. According to the Virginia Department of Education §22.1-16 of the *Code of Virginia,* (1998b) teacher preparation programs should be incorporating the technology standards in their approved plan of study.

Another study could investigate the extent Virginia's colleges and universities incorporate the technology standards in their teacher preparation program. Perhaps research that tested Sullivan and Keating (2000) findings that novice teachers were more technologically literate than veteran teachers could be examined.

5. Another study that would extend this research would be to examine teachers who passed the TSIP and determine if these standards are carried over to the classroom instructional practices and reflected in student performance.

In summary, there are 132 school divisions in the Commonwealth of Virginia. Instructional personnel are required to meet proficiency on eight technology standards or lose their licensure. These standards are interpreted 132 different ways. Also, methods used to assess instructional personnel vary significantly. When students were expected to meet proficiency on the Standards of Learning for technology they were given a standardized assessment, how much more should we expect of teachers who must be accountable to teach our children the technology standards. The VDOE must support school division's by identifying and developing a standardized assessment. Additionally, administrators who evaluate proficiency should be required to demonstrate proficiency on the technology standards and effectively evaluate instructional personnel on the technology standards.

We are in the technological age and our environment is ever changing due to technological advances. Automobiles, appliances, computers, wireless technology, require technology to solve problems. We must prepare our students and leaders of tomorrow to thrive in this technological age. Teachers of today must deliver instruction that optimizes the learning environment for students so they become technologically literate.

Technologically literate persons understand and appreciate the importance of fundamental technological developments. They have the ability to use decision-making tools in all aspects of their lives. Most importantly, they understand that technology is the result of human activity. (International Technology Education Association: Technology for All Americans: A Rationale and Structure for the Study of Technology, 1996 p. 11)

The promise of the future lies not in technology alone, but in people's ability to use, manage, and understand it. (p. 3)

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APPENDICES

Appendix A

Virginia Technology Standards for Instructional Personnel

Statutory Authority: §22.1-16 of the Code of Virginia

8 VAC 20-25-10. Definitions.

The following words and terms, when used in this regulation, shall have the following meaning unless the context clearly indicates otherwise:

Demonstrated proficiency means a demonstrated level of competence of the technology standards as determined by school administrators.

Electronic technologies means electronic devices and systems to access and exchange information.

Instructional personnel means all school personnel required to hold a license issued by the Virginia Board of Education for instructional purposes.

Productivity tools means computer software tools to enhance student learning and job performance.

8 VAC 20-25-20. Administration of technology standards.

A. School divisions and institutions of higher education shall incorporate the technology standards for instructional personnel into their division-wide technology plans and approved teacher education programs, respectively, by December 1998.

B. School divisions and institutions of higher education shall develop implementation plans for pre-service and in-service training for instructional personnel. The implementation plan shall provide the requirements for demonstrated proficiency of the technology standards.

C. Waivers shall be considered on a case-by-case basis of the 18-hour professional studies cap placed on teacher preparation programs for institutions requesting additional instruction in educational technology.

D. School divisions shall ensure that newly-hired instructional personnel from out of state demonstrate proficiency in the technology standards during the three-year probation period of employment.

Technology Standards for Instructional Personnel (8 VAC 20-25-10)

E. Course work in technology shall satisfy the content requirement for licensure renewal for license holders who do not have a master's degree.

F. School divisions shall incorporate the technology standards into their local technology plans and develop strategies to implement the standards by December 1998.

G. Institutions of higher education shall incorporate technology standards in their approved program requirements and assess students' demonstrated proficiency of the standards by December 1998.

8 VAC 20-25-30. Technology standards for Instructional Personnel.

A. Instructional personnel shall be able to demonstrate effective use of a computer system and utilize computer software.

B. Instructional personnel shall be able to apply knowledge of terms associated with educational computing and technology.

C. Instructional personnel shall be able to apply computer productivity tools for professional use.

D. Instructional personnel shall be able to use electronic technologies to access and exchange information.

E. Instructional personnel shall be able to identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives.

F. Instructional personnel shall be able to use educational technologies for data collection, information management, problem solving, decision-making, communication, and presentation within the curriculum.

G. Instructional personnel shall be able to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings.

H. Instructional personnel shall demonstrate knowledge of ethical and legal issues relating to the use of technology.

Source: Virginia Department of Education

Printed by permission from Dr. Lan Neugent, the assistant superintendent for technology at the VDOE

Appendix B

Virginia Technology Standards for K-12 Students

The Computer/Technology Standards by the End of Grades Five and Eight identify technology skills for improving student learning through the integration of technology across the curriculum. Mastery of these skills results in students who are both computer literate and competent in the application of technology tools to support their learning needs.

In grades nine through twelve, technology continues to be integrated across the curriculum. The goal is that students in these grades achieve a higher level of mastery in the application of technology in their learning. The following standards identify essential skills for the student's appropriate use of existing and emerging technology tools for communication, productivity, management, research, problem-solving, and decision making.

C/T12.1 The Student will demonstrate a basic understanding of fundamental computer operations and concepts.

- Successfully operate a multimedia computer system with related peripheral devices.
- Demonstrate touch-typing skills in computer use.
- Use terminology related to computers and technology appropriately in written and oral communications.
- Describe how imaging devices may be used with computer systems.
- Describe how computers may be connected to form a telecommunication network.
- Analyze and solve simple hardware and software problems
- Identify new and emerging technologies.

C/T12.2 The student will use application software to accomplish a variety of learning tasks.

- Use advanced features of word processing, desktop publishing, graphics programs, and utilities in learning activities.
- Use spreadsheets for analyzing, organizing and displaying numeric data graphically.
- Design and manipulate databases and generate customized reports.
- Use features of applications that integrate word processing, database, spreadsheet, telecommunication, and graphics.
- Identify, select, and integrate video and digital images in varying formats for creating multi-media presentations, publications and/or other products.
- Select, evaluate, and use appropriate technology for research and data collection.
- Apply specific-purpose electronic devices (such as, a graphing calculator, scientific probeware, or multi-function keyboards) in appropriate content areas.

C/T12.3 The student will develop skills in the use of telecommunications networks.

- Use local, wide area and worldwide network communication systems to access, analyze, interpret, and synthesize information.
- Compare and contrast the use of local area networks, wide area networks and worldwide networks.
- Access and use telecommunications tools and resources for information sharing, remote information access and retrieval, and multi-media/hypermedia publishing.
- Demonstrate an understanding of the concepts of broadcast instruction, audio/video conferencing, and other distance learning applications.
- Explain legal, personal safety, network etiquette, and ethical behaviors regarding the use of technology and information.

C/T12.4 The student will demonstrate skill in the selection and use of appropriate technologies to gather, process and analyze data and to report information related to an investigation.

- Design and use a wide range of effective search strategies to acquire information.
- Use a wide variety of electronic media and databases to search for and retrieve information.
- Evaluate the usefulness, appropriateness, currency, and reliability of acquired information.
- Select appropriate technology for communicating information for an intended purpose and audience.
- Utilize a variety of media and resources in collaboration with peers, experts, and other to design a learning activity and/or presentation.
- Appropriately cite electronic resources in gathering information.
- Apply Copyright and Fair Use Guidelines in reporting information.

Source: Virginia Department of Education (2002)

Printed by permission from Dr. Lan Neugent, the assistant superintendent for technology at the VDOE

Appendix C

Methods Used to Determine Technology Competencies for Virginia Teachers

Part I. Directions: *The purpose of this section of the survey is to determine which method(s) you use in your school division to ensure that teachers are proficient on the Virginia's Technology Standards. For each of the 6 possible methods noted below, please answer the following:*

Used? (Is this method used in your division?) If yes, please click "Y." If no, please click "N."

For each method that you have indicated "Y" (that is, it is used in your division), please answer two additional questions.

Under Column A, **"**What grade would you give the **effectiveness** of this method used in your school division?" Please "grade" each of these methods using the "A" to "F" scale provided with "A" indicating extremely effective and "F" indicating "extremely ineffective."

Under Column B, Is the method you use in your school division **cost efficient?** If yes, please click "Y." If no, please click "N."

Methods	Used?	Column A What grade would you give the effectiveness of this method?	Column B Is this method cost efficient?
1. Is **Computer-Based Assessment** a method your school division uses to assess proficiency on the technology standards? (Individuals take a school division test on the computer to assess technology skills.) Briefly describe the computer-based method in the write-in box below:	Y N	A B C D F	Y N
2. Is **Performance Assessment** on the computer a method your school division uses to assess teachers' proficiency on the technology standards? (The individual produces assignments specified by the school division on the computer and sends it electronically to a designated place or teachers are asked to perform several specified tasks on the computer.) Briefly describe the performance assessment on the computer method in the write-in box below:	Y N	A B C D F	Y N
3. Is the **Portfolio Assessment** a method your school division uses to assess teachers' proficiency on the technology standards? (The individual produces assignments specified by the school division on the computer, prints it out, and keeps it in a notebook or submits a disk to the appropriate school official.) Briefly describe the portfolio assessment method your school system uses in the write-in box below	Y N	A B C D F	Y N

Methods	Used?		Column A What grade would you give the effectiveness of this method?					Column B Is this method cost efficient?	
4. Is **Paper/Pencil Assessment** a method your school division uses to assess proficiency on the technology standards? (The individual responds to specified items by the school division on paper using a pencil.)	Y	N	A	B	C	D	F	Y	N
If your school division uses this method has this method been tested for validity?	Y	N							
If your school division uses this method has this method been tested for reliability?	Y	N							
Briefly describe the paper pencil method in the write-in box below:									
5. Is **Professional Development** a method your school division uses to assess proficiency on the technology standards? Professional development (defined as training approved by the school division that is designed to teach the technology standards) is divided into 3 categories: **workshops**, **college courses** and **mentoring.** Please click those that apply:									
a) Workshops	Y	N	A	B	C	D	F	Y	N
b) College courses	Y	N	A	B	C	D	F	Y	N
c) Mentoring	Y	N	A	B	C	D	F	Y	N
In the write-in box below describe the duration of the workshop, the course or briefly describe the mentoring (i.e., Is the workshop one 8-hour day? Is the college course 2 times a week for 1 semester? Who provides the mentoring?)									
6. Is the **Signed Demonstrated Proficiency Statement** a method your school division uses to assess proficiency on the technology standards? (A supervisor of the employee or the employee signs a statement verifying that the teacher met the technology standards.)	Y	N	A	B	C	D	F	Y	N

Part II. Directions: *Please respond to the following questions:*

1. If you graded the effectiveness of your school division's method a C or below, **please identify the method** and then **specify how this method could be better**?

____

____

2. What percent of your teachers have met proficiency on the technology standards as determined by the Virginia Department of Education as of June 30, 2002? _________________percent

3. Check the following incentives that your school division offers for meeting demonstrated proficiency on the technology standards: Check all that apply.

____relicensure points
____laptop computer
____one-time monetary stipend
____certificate
____plaque
____banner
____name identified in the school paper
____other type of incentive, please specify:____

---

4. May I contact you by phone or email for clarification or more information?
YES_____ NO_____ (If yes, fill out name and information below.)

5. Would you like a summary of the results of this study? YES_______NO_______
(If yes, please fill out name and information below.)

NAME:_____________________________Title:____________________________________

Email:____

Phone number: (______) _______-____________

Address:____

City/State:___________________________________ZipCode:___________________________

Thank you for your time. I greatly appreciate it!

Linda S. Hayes lihayes@cox.net

Appendix D

Survey Cover to Letter

Hampton Roads Graduate Center

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

418 Pembroke Four
Virginia Beach, VA 23452
757-552-1880

November, 2002

Dear Colleague,

My name is Linda Hayes, and I am a doctoral candidate at Virginia Tech. I am conducting a survey on the various ways school divisions throughout Virginia assess teacher proficiency on the Technology Standards for Instructional Personnel (TSIP). As the person responsible for supervising technology in your school division, your input is vital to my research. I would appreciate you completing a survey for me electronically.

The web site for this survey is: http://65.210.110.68
Your PIN # is ________. You will not be able to take this survey without this PIN #. The survey will take you approximately 10-15 minutes to complete. If you are not the person in your office responsible for overseeing the process or method your school division uses to ensure that teachers are proficient with the Virginia Technology Standards for Instructional Personnel, then please forward this email and the survey to the proper person.

The information you submit is confidential and you will not be identified, nor will your school division be identified. All information will be aggregated for statistical analysis. If you would like a copy of the summary results of my study, please complete the necessary information at the end of the survey, and I will gladly forward them.

Thank you for completing this survey.

Linda S. Hayes	Dr. Travis W. Twiford
lihayes@cox.net	Director
Virginia Tech, Doctoral Candidate	Tidewater Doctoral Program
	Virginia Tech

Appendix E

Studies Identified in Chapter II

Citation	Purpose	Methods	Findings	Implications
Bartley (2001)	To report elementary teacher perceptions of what they understand the Technology Standards for Instructional Personnel to mean, and to design descriptions for these standards so that future state assessment instruments will be created with respect to their perceptions.	Ten teachers with technology training were selected from one elementary school in a moderately large school system in Virginia, with a student enrollment of 12,000. These ten teachers represented Kindergarten through fifth grade, special education, administration, technology support personnel, and non-content specialty areas. This study was qualitative, and ethnographic in nature. Group discussions, written communication, a survey, and observations were administered	A summary of the interpretations of what the technology standards meant to the ten teachers were noted. A variety of interpretations by the ten teachers were recorded. After individual and group reflection, the ten teachers reworded the technology standards to reflect the elementary culture. The suggested revisions to the Virginia technology standards were reported in this study.	With more than 72,000 teachers in Virginia's public schools, ten teachers (used in this study) is not a sufficient sample to make recommendations to modify the language of the current technology standards. Bartley presented the concern and perceptions of these ten teachers, in a thorough manner. It is interesting to note that the suggested language revisions of the technology standards could easily apply to secondary or elementary personnel. For example, the 8th standard: Instructional personnel shall be able to demonstrate knowledge of ethical and legal issues relating to the use of technology was rewritten to say, "Instructional personnel shall be able to demonstrate knowledge (both in terms of professional development and in your teaching) of ethical and legal issues relating to the use of technology as stated in their division's acceptable use policy." Also it should be noted that each group gave a different suggested revision.

Appendix E

Studies Identified in Chapter II continued

Citation	Purpose	Methods	Findings	Implications
*CCSSO (2001)	To collect information on education in the United States	Questionnaires were sent to 50 state education agencies, 50 were returned	Findings are commentary in nature and may be reviewed in detail in Appendices G, H, I, J, &K	This is a good source as this information is released every two years and every state submits information to the CCSSO
Dale, Shakeshaft, Becker, & Kottkamp (1999)	To describe the West Virginia Basic Skills/Computer Education Program and to connect its features with student test scores	Data were collected from all fifth graders (950) in 18 elementary schools Standford-9 scaled scores, surveys from 290 teachers, attitudes toward technology, teacher training, and access to software and computers a regression analysis was conducted (access, attitude and training model)	The findings suggest these factors account for 11% of the variance in basic skills gain score and is statistically significant at the .001 confidence level. Findings suggest the gain score can be explained for the BS/CE program. The longer the student was exposed to computers, the software and better attitude the higher the gain score on the Stanford-9.	This study would be considered good research, since the state of West Virginia had K-6 (N= 161, 231 students) 950 students were sufficient to gather data at a 95% confidence level. Also the 18 schools were representative of the total population of West Virginia Schools as determined by state agencies, Regional Educational Service Agencies
Dewert (1999)	A survey was administered to describe national educational technology trends across the US	State Technology Directors were interviewed via the telephone that lasted for approximately 75 minutes Data were secured from all 50 states	18 states required pre-service teachers to meet technology-related requirements to receive their initial teaching license, yet only three states required the same from new administrators. Forty-two states responded "No" to requiring teachers to meet technology related criteria for renewal purposes. Arizona just recently established new teacher certification standards. They intend to develop a paper-pencil test that will assess the new certification standards to include technology; however, the paper-pencil test has not been developed yet	This journal referred the reader to a website to find out more information on the survey, yet when the reader went to the website, the site referred to another site and once there the survey information was not reported

Appendix E

Studies Identified in Chapter II continued

Citation	Purpose	Methods	Findings	Implications
Doherty & Orlofsky (2001)	To poll students (by phone) on the access of technology	The sample base came from 11,051 United States public schools whose students participated in the Market Data Retrieval (MDR) and Harris Interactive Poll. These schools were sorted into four geographic (zip code sectional) areas. The total enrollment was 6, 018, 084 students. Five hundred students were polled- telephone interviews chosen at random within these four geographic areas.	Results indicate that computers are not often used to help students understand complex or sophisticated concepts and 50 % of the students reported using the computer at school one hour or less a week. Yet, 90 % of the students reported that computers were usually available at school. “Students reported that the three most popular activities they use school computers for are: ‘to do research for school assignments’ (96percent), ‘to write papers’ (91 percent), and ‘to do homework’ (62 percent).”	The Market Data Retrieval (MDR) and the Harris Interactive Poll is reputable for providing survey methods that are reliable. Data were weighted to reflect the national population of public school students in grades 7-12 also the sampling (500) was sufficient from the total population of 6,018,084 students according to Krejcie & Morgan
Hawkins, Spielvogel, & Panush (1996)	To determine: the particular “design” for technology integration at school sites that seemed to be more advanced in their technology deployment. The study also inquired if the use of technology is connected to reform goals, what is innovative about technology with respect to teaching, learning, or school and district management?	A portfolio of school sites across the country that represented a range of designs for using technologies well were selected- 13 school districts across the country were visited for 2-4 days by at least 2 people from the team. Information was systematically collected through interviews with staff that served in a variety of roles, documents, reports, and local news stories.	Technology of itself almost never causes substantial change in schools; rather technologies are best viewed as playing key roles in solving problems. Four districts were identified out of the 13 that were exemplar also key features were identified as being important for a technological advanced school	This qualitative study could be seen as too subjective at first read, however specific issues were explored at each site and once all the data was collected the team synthesized the data and identified key features considered to be important. This study could be replicated

Appendix E

Studies Identified in Chapter II continued

Citation	Purpose	Methods	Findings	Implications
Hoover (1997)	To determine staff development needs to achieve computer technology competence by instructional personnel	Approximately 400 instructional personnel and 390 were surveyed in Gloucester County Public Schools Current level of technology competency was identified	A staff development plan was designed to meet all identified needs (4 days-6 hours a day) this plan was used to develop an instrument to measure proficiency on the technology standards. Additionally, recommendations for assessment from a committee were proposed	A thorough study, high response rate- the process of designing a staff development plan could be replicated.
Meyer (2001)	To report technology trends in public schools and across the United States	Education Week conducted a survey of state departments of education along with Market Data retrieval- the data I cited came from the state department of education. Each state was cited for information so it is from that information that I knew they obtained the information for the survey. No explanation was given on how the survey was conducted just that the survey cited notes for each of the areas they collected information. For example the notes usually defined what was collected for each area, but not how they collected the data	This survey reported 16 pages of data taken from state surveys. The data addressed access, capacity and use of computers in schools. It reported information on student technology standards, teacher technology standards, which states required standards for licensure and much more information. Information on teacher licensure, and incentives from this article was cited in my paper.	This information is lacking in that it does not explain how the survey was conducted. To confirm the information that I needed for my study (and was not able to find elsewhere), I am contacting the state department in a few states where this articles stated information that was important to this study.

Appendix E

Studies Identified in Chapter II continued

Citation	Purpose	Methods	Findings	Implications
Sanders Tennessee's Value-Added Assessment System (TVAAS) Also Wright, Horn, & Sanders (1997)	To determine student achievement gains from one year to the next	Recorded the mean scale scores, mean scale score gains, and standard errors of measurements in Tennessee students from 2nd-8th grade (456,165 students) on 5 subjects-language arts, reading, history, science, and mathematics	Varied by school district, school, and teacher classrooms	TVAAS is a good statistical tool that allows one to study mixed-model statistics that operates on a longitudinally merged student data base (allows one to use all the data on each child-those records that are complete will weigh heavier than those records that are incomplete)
Sullivan & Keating (2000)	To find out the availability of computers in the school, classrooms, and to teachers, the percentage of computer literate teachers in their school, and how teacher preparation programs assist in better preparing pre-service teachers in computer technology	Surveyed a random sampling of principals in Rhode Island and Southeastern Massachusetts. Surveys were sent to 266 principals and 184 surveys were returned-- 69 % response rate	Only nine respondents indicated that 100% of their teachers were computer literate; 49 respondents indicated that 75-99% of their teachers were computer literate; 61 respondents indicated that 50-74% of their teachers were computer literate; 65 respondents indicated that less than 50% were computer literate	Sixty-nine percent return rate is good. According to Krejcie & Morgan a sample size of 226 should have at least 142 surveys returned and this study had 184 surveys returned.

Appendix F

National Council for Accreditation of Teacher Education Performance Standards

Standard 1. Candidate Knowledge, Skills, and Disposition

NCATE expects candidates to know the content of their field (a major or the substantial equivalent of a major) and possess the necessary knowledge and skill to teach it effectively. Candidate work should focus on student learning. In addition, candidates from accredited institutions gain a liberal arts background along with professional knowledge so that they can develop meaningful learning experiences for all students.

Under the new standards, schools of education must provide evidence that they have used national and state standards to design and deliver the programs, and provide evidence that the candidates can meet the standards. PRASIS II or another content knowledge test may assess subject matter knowledge. Other measures of candidate content knowledge may be used as well. Candidates' ability to synthesize the content to help P–12 students understand it is also evaluated in the new system.

NCATE's constituent members include professional associates in each major subject matter area (i.e., National Council of Teachers of Mathematics, National Science Teachers Association, National Council for the Social Studies, International Reading Association, etc.) These and other associations set content standards for teacher preparation; NCATE uses the standards in the accreditation system. In addition, NCATE is currently working with Educational Testing Service to align its PRAXIS II licensing exams with the profession's standards in the content areas.

Standard 2. Program Assessment and Unit Evaluation

The school of education must have a system in place to assess its candidates-including data on the qualifications of applicants and the performance of candidates and graduates. NCATE expects the school of education to use these data to evaluate and improve the programs. NCATE also expects the education unit to design candidate assessments using professional, state, and institutional standards as the major reference points. The assessments should be embedded in the preparation programs, and should be conducted on a continuing basis, both to help candidates improve their skills and to evaluate candidate progress and competence.

NCATE expects schools of education to use multiple assessments in a variety of forms. They may come from internal sources within the school of education, including tasks used to teach candidates (such as projects, journals), activities of teaching (such as lesson planning, diagnosing individual student needs, reflecting on instruction of students and making changes, creating assessments for students) as well as essays, papers, observation of faculty and supervising teachers, videotapes of performance, and other means. Assessment information will also come from external sources such as state licensure exams, evaluations during induction or mentoring, and employer reports. NCATE expects the institutions to establish criteria for determining levels of acceptable candidate performance. NCATE will also work with national subject matter associations to publish sample benchmarks for acceptable performance in the subject matter areas, and NCATE will establish criteria for the submission of credible evidence.

These data, when arrayed, will provide a more comprehensive picture of the effectiveness of the school of education and its programs than has been available in the past. Title II of the Higher Education Act of 1998 requires the collection and dissemination of teacher candidate results on state licensing exams. The information will be available to the public. This new public accountability mechanism will serve to accelerate the reform of teacher preparation in higher education institutions. NCATE will use the data from state licensing examinations as a factor in accreditation decisions.

Developing an assessment system that collects new information takes time. NCATE has developed a transition plan for the institutions. During the first year of implementation, NCATE Expects institutions to have an assessment plan in place. In each year thereafter, schools of education will be expected to be implementing their systems-collecting, compiling, and analyzing performance data, and piloting and using performance assessments.

Standard 3. Field Experiences and Clinical Practice

The performance-based NCATE system requires university and P–12 school faculty to function as partners in the education of teacher candidates. The school of education and its school partners are expected to collaboratively design, implement, and evaluate field experiences and clinical practice and ensure that candidates demonstrate the knowledge, skills, and dispositions to help all students learn. The emphasis on the partnership between the university and cooperating schools is profound, and will engender change in many current programs.

Standard 4. Diversity

NCATE expects teacher candidates to be able to help all students learn. Candidates should have experiences working with diverse student populations, along with diverse faculty and peers. This standard reinforces NCATE’s commitment to a high quality education for all of America’s children.

Standard 5. Faculty Performance and Development

NCATE expects faculty to be good teachers; they should model best practice in teaching, scholarship and service. The unit must evaluate faculty performance and provide professional development opportunities.

Standard 6. Unit Governance and Resources

This standard ensures that the college has the necessary resources, including technology resources, to offer the programs that it chooses to offer.

Source: NCATE—2010 Massachusetts Avenue NW, Suite 500 Washington DC 20036-1023

Appendix G
Professional Development Requirements for Teacher License Renewal/Recertification—2002

State	Teacher Licensure Renewal/Recertification
Alabama	Three years experience and either 5 CEUs/50 clock hours of professional development or a 3 semester hour course; or 5 CEUs/50 clock hours of professional development and 3 semester hour course; or 6 semester hours of appropriate courses.
Alaska	6 semester credits, 3 in upper division or graduate levels
Arkansas	30 hours per year
California	150 hours every 5 years with area of concentration
Colorado	Six semester hours or 90 clock hours of professional development every 5 years
Connecticut	9 CEUs or 6 grad courses-5 years
Delaware	Delaware's continuing License will require 90 clock hours every 5 years
DoDEA	Six semester credits every 6 years, 3 of the 6 must apply to current teaching category
District of Columbia	6 Hours of College Credit or IS
Florida	6 semester hours or 120 staff development units every 5 years
Georgia	Six semester hours of course work; other renewal requirements include background checks; no more than 1 unsatisfactory performance appraisal in a three-year period; administrators serve 5 days in the classroom as an instructor.
Hawaii	Under development by Hawaii Teacher Standards Board, subject to public hearing and approval
Idaho	Completion of at least 6 semester hours of credit within a 5 year period
Illinois	8 semester hours of college course work; 24 continuing education units; 120 continuing professional development units
Indiana	Standard: 6 semester hrs. major, minor or professional education every 5 years. Master or Professional: 90 hours Continuing Renewal Credits (CRUs) or 6 semester hours major, minor or professional education every 5 years.
Iowa	Six credits every five years which may be composed of staff development activities.
Kansas	8 sem. Cr. (B.A.), 6 sem. Cr. (M.A.) every 5 years
Kentucky	1st 5-yr renewal: 15 grad hrs; 2nd 5-yr renewal: Approved Master's program or approved Fifth year program (32 graduate hrs); Subseq. 5-yr renewals: 3 yrs of classroom teaching during last 5-yrs or 6 sem. hours of additional graduate credit.
Louisiana	State mandated 2 additional work days for staff development/school improvement for all teachers
Maryland	6 credits during the first five years to move from Standard Professional Certificate level 1 to level 2; 6 additional credits during subsequent 5 years to move from level 2 to level 3; 36 credits to move to Advanced Professional Certificate.
Massachusetts	Focus on academic studies/content knowledge. Please see: http://doe.mass.edu/
Michigan	Six semester hours or 18 SBCEU for renewal of professional certification
Minnesota	125 clock hours
Mississippi	10 CEUs or 5 CEUs and 3 semester hours or 6 semester hours every 5 years
Missouri	30 clock hours
Montana	60 units every five years
Nebraska	2 years experience, or 6 semester credits every 7 years
Nevada	6 semester hours for renewal period (5-6 years)
New Hampshire	75 clock hours
New Jersey	100 hours professional development every 5 years
New Mexico	—
New York	Feb. 2004: 175 hrs. for all professional certificate holders (5 year cycle)
North Carolina	15 credits every 5 years (3 credits in technology). K-8 teachers 3 credits in reading methods.
North Dakota	4 semester hours every 5 years
Ohio	Every five years, six semester hours or 180 contact hours CEUs or equivalent activities approved by local professional development committees. Second 5 yr. renewal requires master's degree or equivalent in graduate hrs.
Oklahoma	Teach 3 of 5 yrs and must have 75 professional development points every 5 years or 5 semester hrs or 75 professional

Appendix G Continued

	development points or a combination may substitute for every 3 years of employment for renewal.
Oregon	125 Continuing Professional Development units every five years
Pennsylvania	Increased levels of on-going professional development to maintain current certificate
Rhode Island	Six to nine credit hours or the completion of an I-Plan (an individual professional development plan)
South Carolina	Six hours of certificate renewal credit every 5 years in content area
South Dakota	Six semester hours germane to their area of certification
Tennessee	Six semester credits or equivalent in professional development points
Texas	150-200 hours, 5 year standard certificate
Utah	Level 1: Professional development directed by the local school district. Level 2: three years experience and 100 professional development points over five yrs. Level 3: 3 yrs experience and 100 professional development points over 7 yrs.
Vermont	180 professional development points every 5 years
Virgin Islands	Requirements are currently being reviewed.
Virginia	Renewal required the accrual of 180 professional development points every five years. Refer to the following web site: http://www.pen.k12.va.us/VDOE/Compliance/TeacherEd/remanual.pdf
Washington	150 clock hours every 5 years
West Virginia	Six semester hours
Wisconsin	6 semester credits every 5 years or 180 clock hours professional development (30 hrs.=1 credit)
Wyoming	Local Decision

Source: Council of Chief State School Officers. (2002). Key State Education Policies on PK-12 Education: 2002. Washington, DC: Author.

Appendix H
States Requiring Teacher Assessments for New License—2002

State	Basic Skills	Professional Knowledge	Subject Matter	Portfolio	When?	Classroom Observation	When?
Alabama	Prospective Teacher Test	by institution	by institution	Optional	Prior to program completion		
Alaska	Praxis I/PPST						
Arizona	by institution	by institution	by institution	Yes	After employment		
Arkansas	PPST/CBT	Praxis II	Praxis II				
California	CBEST	RICA	Praxis II				Pending
Colorado	PLACE			Yes	Exit pre-service	Yes	
Connecticut	Praxis I/PPST		Praxis II ACTFL	Yes	Initial 2 years		
Delaware	Praxis I/PPST	Praxis II					
DoDEA							
Dist. of Columbia	Praxis I		Praxis II				
Florida	CLAST	FTCE /Praxis II	FTCE/Praxis II	Yes	Yes		
Georgia	PPST/CBT		Praxis II				
Hawaii	PPST/CBT	PLT	Praxis subject tests				
Idaho	by institution	Praxis II	Praxis II				
Illinois	Illinois Enhanced Basic Skills Test	Assess. of Prof. Teaching Test	State Subject Matter Test				
Indiana	Praxis I	Praxis II	Praxis II				
Iowa	by institution						
Kansas		PLT	Praxis II	Yes	Intial 2 years		
Kentucky	by institution	PLT	Praxis II	Yes	Prior to 2nd yr.	Yes	Prior to 2nd year
Louisiana	PPST	PLT	Praxis II	Yes		Yes	During 1st year
Maine	Praxis I/PPST						
Maryland	Praxis I	PLT/Praxis II	Praxis II	Yes	Prior to program completion		
Massachusetts	MA Teacher Test	MA Teacher Test	MA Teacher Test				
Michigan	MI Test for Teacher Certification	by institution	by institution				
Minnesota	PSST/CBT						
Mississippi	Praxis I	PLT	Praxis II				
Missouri	C-BASE	PLT	Praxis II				
Montana	PPST						
Nebraska	PPST						
Nevada	PPST	PLT	Praxis II				
New Hampshire	Praxis I/PPST	Praxis II		No			
New Jersey	by institution	PLT				1 yr mentoring	Prior to Standard Lic.
New Mexico	NM Teacher Assessments	NM Teacher Assessments	NM Teacher Assessments			Yes	Renewal Lic.
New York		Assessment of Teaching Skills	Content Specialty Test/Liberal Arts and Sciences Test				
North Carolina	PPST		Praxis II	No	Initial 3 years	Yes	Inital 2 years
North Dakota	PPST						
Ohio		PLT	Praxis II	No		Yes	Entry year

Appendix H Continued

Oklahoma	OGET	OPTE	Oklahoma Subject Area Test	Yes	Initial Licensure	Yes	Teacher prep
Oregon	PPST/CBT/CBEST	Praxis: Math Ped.		Yes		Yes	Con't. licen.
Pennsylvania	PPST	PLT		Yes			
Rhode Island		PLT					
South Carolina	Praxis I	PLT	Praxis II			Yes	Prior to ADEPT
South Dakota	PPST	PLT	Major Field Assessments (MFAT)	Yes	Pre-service		
Tennessee	PPST	PLT	Praxis II			Yes	3rd year prior to professional licensure
Texas	by institution	ExCET/	ExCET/ TExES	TExES		Yes	
Utah	by institution	PLT	by institution	Yes	1/1/03: To obtain Level 2 Licensure (1-3 yrs.)	Yes	1/1/03: To obtain Level 2 Licensure (1-3 yrs.)
Vermont	Praxis I	Praxis II					
Virgin Islands							
Virginia	Praxis I	Praxis II					
Washington	WEST-B	9/2003: Observ. in Student Teaching	9/2005:Praxis II			Yes	
West Virginia	Praxis I	PLT	Praxis II			Yes	
Wisconsin	Praxis I			Yes		Yes	
Wyoming							
	Written: 43				Performance: 21		

PRAXIS I/PPST: Pre-Professional Skills Test
PRAXIS II/PLT: Principles of Learning and Testing
CBEST: California Basic Education Skills Test
FTCE: FLorida Teacher Certification Examination
OGET: Oklahoma General Education Tests
RICA: Reading Instructional Competence Assessment
PLT: Prinicpals of Learning and Teaching
OPTE: Oklahoma Professional Teaching Exam
ACTFL: American Council on Teaching Foreign Languages
C-BASE: College Basic Academic Subject Examination
TExES: Texas Examination of Educator Standards
CLAST: College Academic Skills Test
MFAT: Major Field Assessments Test
ExCET: Examination for Certification of Educators
WEST-B: Washington Educator Skills Test-Basic

Source: Council of Chief State School Officers. (2002). Key State Education Policies on PK-12 Education: 2002. Washington, DC: Author.

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Appendix I

Elementary Teachers: State Requirements in Academic Fields for Elementary License—2002

State	Grades	Requirement	Major/Minor Required
Alabama	K-6	State knowledge/ability standards	—
Alaska	K-8	Institution-specific/NCATE Standards	
	Major/Minor		
Arizona	K-8	Credits: 6 Eng/LA, 6 Math, 8 Science	—
Arkansas	1-6	State competency standards/NCATE standards	—
California		Subject matter examination/Approved Program	—
Colorado	K-6	Approved Program	
	Major		
Connecticut	1-6	39 cr. In 5 of 6 areas: Eng., Sci., Math, Soc. St., For. Lang., Art, plus 3 US Hist.	
	Major		
Delaware	K-4, 5-8	Credits: 9 Eng/SSt, 9 Math, 12 Sci, 6 Fine Arts/US History	—
DoDEA	1-8	U.S. citizen, 40 hr. gen. Ed, 18 hrs. Elementary education	—
Dist. Of Colum.	1-6	60 hrs: Math, Read., Lang. Arts, Soc. St., Sci., HE, PE, Fine Arts	
	Major		
Florida	1-6	No specific state requirements, Major in Elem. Ed. Or 24 hrs.	—
Georgia	ECE-5	30 hrs: Comm. Arts, Social-Beh. Sci., Sci/M, Art and Humanities, HE and PE.	—
Hawaii	K-6	Education in Elementary Education.	—
Idaho	K-8	44 hrs. of gen. Ed.: Hum., Soc. St., Art, Math, Phy, Sci, Bio. Sci, and Lang. Skills; 24 hr. teacher	
prep.	—		
Illinois	K-9	State knowledge/ability standards; 16 hr. professional ed. Courses	—
Indiana	1-6	70 hrs. minimum in general education, including 9 Eng, 6 Math, US Hist & Civics, Dev. & Diag.	
Rdg	Major/Minor		
Iowa	K-6	Approved Program/field of specialization or Interdisciplinary of 12 hr.	—
Kansas	K-6	Subject matter is specified in terms of content to be included in curriculum of study.	—
Kentucky	P-5	Learned Society/S.P.A. & Praxis II, PLT	—
Louisiana	1-8	55 semester hours in general ed., plus 3 each Child. Lit., Art, Music, Speech, 2 Nutrition Ed., 4 PE	
	—		
Maine	K-8	No specific state requirements	
	Major		
Maryland	1-6	9 Eng/LA, 12 Math, 12 Sci, 9 Soc St, 12 Elementary Reading	—
Massachusetts	1-6	24 hrs/Experience in field of knowledge	—
Michigan	K-6	Mjr. (30-36 hr.) & Minor (20-24 hr.), or 3 Minors (20 hr.), plus 6 Teach. Of Reading	
	Major/Minor		
Minnesota	1-6	No specific state requirements	
	Major/Minor		
Mississippi	K-4	12 Eng/LA, 21 Math/Sci, 12 SSt, 6 Reading, 3 SpEd, 6 Fine Arts	—
Missouri	1-6	Approved Program covering Humanities, Comm. Skills/Eng., M, SSt, Nat. Sci; 21 hrs.	
concentration	—		
Montana	K-8	Approved Program; 30 hr. general ed.	—
Nebraska	K-6	No specific state requirements	
	Major		
Nevada	K-8	Approved Programs or 30 hrs. prof. Ed.	—
New Hampshire	K-8	Courses in subject area taught	—
New Jersey	N-8	60 hrs. gen. Ed.: Art, Hum., M, Sci, Tech, SSt, 9 Beh. Sci , 30hrs.: coherent study in Art, SSt, M, S	
	—		
New Mexico	K-8	54 hr. gen ed., 30-39 hr. prof. Ed., 24-36 hrs in teaching field, 12-24 electives	—
New York	B-2, 1-6	Feb. 2004: Gen. Ed. Core, at least 6 each: Eng/LA, Math, Sci, Soc. St, FL, plus Con. Sci, Tech.	
	Major		
North Carolina	K-6	Institution specific subject requirements	—
North Dakota	K-8	Approved Program; 34 hr. el. Ed.	—

Appendix I Continued

Ohio	PK-3	NAEYC	—
Oklahoma	1-8 Major/Minor	Subject area concentrations	
Oregon	P-4, 3-8 Major		
Pennsylvania	K-6		—
Rhode Island	1-6	No specific state requirements	—
South Carolina	1-8	Subject specific requirements, institution specific/NCATE standards	—
South Dakota	K-8 Major		
Tennessee	K-8 Major	State licensure standards	
Texas	1-8	18 – 24 hrs. in 1 of 36 appr. Subj. areas	—
Utah	1-8 Major	Approved Program	
Vermont	K-6	Approved Program/No specific state requirements	—
Virginia	PK-6	Specific program approval standards	—
Washington	K-8	Subject Endorsement added	—
West Virginia	K-8	Competence verification: Read., LA, M, S, SSt, HE, PE, Fine Arts	—
Wisconsin	1-6, 1-9 Major/Minor	Minor in one field	
Wyoming	K-8 Major	Approved Teacher Education Program: E/LA, S, SSt, AR, PE	

Source: Council of Chief State School Officers. (2002). Key State Education Policies on PK-12 Education: 2002. Washington, DC: Author.

Appendix J
Middle Grades: State Requirements in Academic Fields for Middle Grade License—2002

State	Grades	Requirement	Major/Minor Required
Alabama	4-8	State knowledge/ability standards	—
Alaska	6-9	Requirements are specified by approved program	Major/Minor
Arizona	5-9	Endorsement may be attached to elem. or sec. certificate; 6 hrs.: upper division or grad. course work	—
Arkansas	5-8	State competency standards/NCATE standards	—
California	No	Subject matter examination/Approved Program	—
Colorado	5-9	Major in subject matter taught, specific components in program	Major
Connecticut	4-8	39 hrs. in 5 of 6: E/LA, Nat. Sci., M, SSt, and For. Lang or Fine Arts, 24 cr. in one subject, 15 add. subject	Major
Delaware	5-8	9 Eng, 9 Math, 12 Sci (B/P/E), 8 US Hist, 6: Fine Arts	—
DoDEA		18 hrs. with appropriate distribution: English, Speech, Journalism, SSt, Gen Sci, HE, M	—
Dist. of Colum.	5-8	Major in subject area taught	Major
Florida	No	Specific min. no. of units in the subject area taught	Major/Minor
Georgia	4-8	30 hrs. in at least two areas applicable to the mid. grades. Min. of 15 sem. hrs. in LA, S, SSt or M	—
Hawaii	No	Requirements specified by approved program	—
Idaho	No	No specific state requirements	—
Illinois	5-8	18 hrs. in subject area. Mid. Grades Endorsement, 3: Mid. Gr. Phil., C & I, 3: Adol. psych. & role of teacher	—
Indiana	1-9	Endorsement: Elem. plus 18 hr. in subject area, 6 hrs. profess. education (junior high)	Major/Minor
Iowa	No	No specific state requirements	—
Kansas	5-8	Subject matter specified in terms of content	—
Kentucky	5-9	Learned Society/S.P.A. & Praxis II	Minor Equivalent
Louisiana	1-8	55 hrs. Gen Ed., 3 each: Child. Lit, Speech, Sch. Music, Sch. Art, 2: Nut. Ed.	—
Maine	K-8	60 hrs. liberal arts, including 6 each: Eng, Math, Sci, Soc. St.	Major
Maryland	No	—	—
Massachusetts	5-6	Major in the subject area taught; 24 hrs./Experience.	Major
Michigan	6-8	Major (30-36 hr.) & Minor (20-24 hr.), or 3 Minors (20), and 18 hrs. planned program	Major
Minnesota	5-9	Either Elem. or Sec. License, min. 24 qrt. hrs. Mid. Gr. Education, add'l 12 in field with elem lic. only	Major/Minor
Mississippi	4-8	Mid. Schl Endorsement: K-4 End. plus 18 hrs. each: E, R, M, S, SSt, S/HE/PE, FA, Comp., FL, M/Comp., S/Comp.	—
Missouri	5-9	Min. of 21 hrs. required in content area	—
Montana	K-8	No specific state requirements	—
Nebraska	4-9	No specific state requirements	Major
Nevada	No	No information	—
New Hampshire		Only three areas mathematics, social sciences and general education	—
New Jersey	No	No specific state requirements	—
New Mexico	5-9	24 -39 hrs. in at least one teaching field: M, S, LA, Read, SSt; 12 hr. upper level	—
New York	5-9	Specialist: Major/Equiv. in subj. taught; Generalist: Major/Equiv. in lib. arts/sci.; State Learning Standards (2004)	Major
North Carolina	6-9	License subject specific: min. 18 hrs. course work in subject	—
North Dakota		Major/Minor in the subject area taught, specific components in program	—
Ohio	4-9	NMSA-R/LA, M, S, SSt	—
Oklahoma	5-9	Grades 7 & 8 M/S require cert. at Sec. level	Major/Minor
Oregon	5-10	Major in the subject area taught	Major
Pennsylvania	5-9		—

Appendix J Continued

Rhode Island	No	Major/Minor in the subject area taught; Specific components in program	Major/Minor
South Carolina	5-8	Two areas of concentration in academic areas, meet institutional/NCATE standards	—
South Dakota	5-8, 7-8/9	Specific min. no. of units in subject area taught; specific components included in the program	Major
Tennessee	5-8	State licensure standards; two areas of concentration	Major
Texas		Major in subject area taught	—
Utah	6-9	Major/Minor in the subject area taught; specific minimum no. of units in subject area taught	Major/Minor
Vermont	5-8	Two 18 hrs. minors plus course work in Mid. Grades Education	Minor
Virginia	6-8	Specific components to be included in program	—
Washington	No	Specific min. no. of units in subject area taught; specifies components included in program	—
West Virginia	5-9	Verification of competence based on job-related objectives.	—
Wisconsin	5-9	Major or minor in the subject area taught	Major/Minor
Wyoming	5-8	Comp. in Mid. gr. mgmnt., char., content & methods. Emph. on major & supporting field of study	Major

Source: Council of Chief State School Officers. (2002). Key State Education Policies on PK-12 Education: 2002. Washington, DC: Author.

Appendix K

Secondary Teachers: State Requirements for License in English/Language Arts, Mathematics, Science, Social Studies, 2000

State	State Requirement	- - - - - - Course Credits by Field - - - - -					
		E/LA	M	Sci	B, C, P, ES	SSt	H, Ec, PS, Geo
Alabama	State knowledge/ability standards						
Alaska	Institution-specific/NCATE						
Arizona	Major (24 credits)						
Arkansas	Major or minor in assigned subject						
California		45	45	60	30	45	45
Colorado	Major						
Connecticut		30	30	30	30	30	30(H)
Delaware		36	36	—	42(b,es);45(c.p)	48	—
Florida	Major (30 credits)						
Georgia	Major						
Hawaii	Major						
Idaho	Major or minor						
Illinois		32	32	32	32	—	32
Indiana		36	36	36	36	—	36
Iowa		24	24	24	24	24	15
Kansas	Standards-based						
Kentucky	Major or minor (30 credits)						
Louisiana	15-50 sem. hrs. in subject area						
Maine	Major						
Maryland	Major						
Massachusetts		36	36	36	36	—	24
Michigan	Major (36) and minor (24)						
Minnesota	Major or minor in assigned subject						
Mississippi	Credits specific to field						
Missouri		30	30	30	20	40	—
Montana		30/20	30/20	40	30/20	40	30/20
Nebraska		30	30	59	24	60	36
Nevada	Major						
New Hampshire	Major in core subjects						
New Jersey	Major in subject						
New Mexico		24-36	24-36	24-36	—	24-36	—
New York		36	36	—	36	36	—
North Carolina	Approved program/Competencies in subject						
North Dakota		30	30	—	30	—	30
Ohio		30	30	60	30	—	30
Oklahoma		24-40	24-40	24-40	24-40	24-40	24-40
Oregon	Major					—	
Pennsylvania	Approved program/Specific components						
Rhode Island		30	30	30	30	—	30
South Carolina		30	30	30	30	30	30
South Dakota		21	18	21	12(b,c,p);18(es)	24	18
Tennessee		36 qtr,	36 qtr.	48 qtr.	24 qtr.	—	24 qtr.
Texas		24	24	48	24	24	24
Utah		45 qtr.	45 qtr.	—	69(b,es);45(c.p)	69	45
Vermont	Approved program/Competency-based						

Appendix K Continued

Secondary Teachers: State Requirements for License in English/Language Arts, Mathematics, Science, Social Studies, 2000

State	State Requirement	Course Credits by Field					
		E/LA	M	Sci	B, C, P, ES	SSt	H, Ec, PS, Geo
Virginia		36	36	—	32	51	—
Washington		45/24 qtr.	24 qtr.	45 qtr.	24 qtr.	45	24
West Virginia	Competence on job-related objectives						
Wisconsin		34	34	54	34	54	34
Wyoming	Approved program & major						

Notes: "—" No state requirements. 30/20 = major or minor. "Credits: = semester credits, unless quarter credits specified. States also require professional

education credits. E/LA = English/Lang. Arts, M = Math, Sci = Broad Field Science, B = Biology, C = Chemistry, P =Physics, ES = Earth Science SSt =

Social Studies, H = History, Ec = Economics, PS = Pol. Sci., Geo = Geography.

Source: NASDTEC Manual on the Preparation and Certification of Education Personnel, 1999-2000.

Council of Chief State School Officers, State Education Assessment Center, Washington, DC.

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Appendix L

Teacher Certification Regulations of 1936

1. Basis for Employment- No teacher may be legally employed by any school board in the state unless he holds a Virginia teacher's certificate of license in full force and effect. The State board of Education is the only agency empowered by law in Virginia to issue a teacher's certificate. The holder of a certificate is entitled to teach in any county or city of the State, subject to the endorsement of the division superintendent, the subjects named on the face of the certificate until such time as the certificate may expire or be revoked.
2. Eligibility- The applicant must:
   - be at least eighteen years of age
   - possess high moral character and integrity in accordance with the West law, present credit for completion of courses in (a) physical training, and (b) school hygiene, including the physical inspection of school children
   - maintain an average grade of at least fair (C) in academic and professional courses pursued in preparation for teaching
   - present a receipt for poll tax, if assessable in Virginia
3. Designation by what we now term as an Approved Teacher Preparation Program
   - Standard College
   - Standard Normal School
   - High School Unit
4. Tenure of Certificates- Collegiate professional was issued for a period of 10 years with the privilege of renewal, subject to regulations for such renewals for periods of 10 years.

5. Qualifications of Administrators and Supervisors
6. Requirements for Teachers' Certificates

Collegiate Professional- issued to the holder of a baccalaureate degree conferred by a standard university, teachers college, arts college, or technical college, who has completed at least 9 college session hours' work in teacher-training courses.

   a. Science
   b. Library

Collegiate- issued to the holder of a baccalaureate degree conferred by like institutions as the collegiate professional, who has at least 1 session hour's credit in school and community hygiene, including the physical inspection of school children. It is issued as a four-year non-renewable license, but may be converted to a Collegiate Professional on completion of at least two years successful teaching experience and 9 hours' work in professional subjects.

Special- certificates for instructors in evening, part-time, and day unit classes. Qualifications for this certificate included in Certification of Trade and Industrial Teachers.

Normal Professional- issued on completion of the prescribed program of studies which attendance at a standard normal school or teacher's college. It entitles the holder teach all subjects in the elementary grades, it is issued for five years, and is subject to renewal for periods of five years.

Local Permit-issued by the Department of Education as local county permits, on the recommendation of the division superintendent, to applicants who are available and whose training approximates required for minimum grade of license when the numbers of licensed teachers is insufficient to moot the demands of any school division.

Source:Edwards, B. (1985). A history of teacher certification in Virginia. Commonwealth of Virginia Department of Education, Division of Legislative Services.

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Appendix M
Alignment of ISTE National Educational Technology Standards with Proposed Programs

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
I. Technology Operations and Concepts. Teachers demonstrate a sound understanding of technology operations and concepts. Teachers:	**TF-I. Technology Operations and Concepts. Educational technology facilitators demonstrate an in-depth understanding of technology operations and concepts. Educational technology facilitators:**	**TL-1. Technology Operations and Concepts. Educational technology leaders demonstrate an advanced understanding of technology operations and concepts. Educational technology leaders:**
A. Demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Education Technology Standards for Students).	A. Demonstrate knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Educational Technology Standards for Teachers).	A. Demonstrate knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Education Technology Standards for Teachers).
	1. Assist teachers in the ongoing development of knowledge, skills, and understanding of technology systems, resources, and services that are aligned with district and state technology plans.-	1. Identify and evaluate components needed for the continual growth of knowledge, skills, and understanding of concepts related to technology.
	2. Provide assistance to teachers in identifying technology systems, resources, and services to meet specific learning needs.	2. Offer a variety of professional development opportunities that facilitate the ongoing development of knowledge, skills, and understanding of concepts related to technology.
B. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.	B. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.	B. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.
	1. Model appropriate strategies essential to continued growth and development of the understanding of technology operations and concepts.	1. Offer a variety of professional development opportunities that facilitate the continued growth and development of the understanding of technology operations and concepts.
NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
II. Planning and Designing Learning Environments and Experiences. Teachers plan and design effective learning environments and experiences supported by technology. Teachers:	**TF-II. Planning and Designing Learning Environments and Experiences. Educational technology facilitators plan, design, and model effective learning environments and multiple experiences supported by technology. Educational technology facilitators:**	**TL-II. Planning and Designing Learning Environments and Experiences. Educational Technology Leaders assist by planning, designing, and modeling effective learning environments and experiences supported by technology at the district/ state/ regional level. Educational Technology Leaders:**
A. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.	A. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.	A. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	1. Provide resources and feedback to teachers as they create developmentally appropriate curriculum units that use technology.	1. Research and disseminate project-based instructional units modeling appropriate uses of technology to support learning.
	2. Consult with teachers as they design methods and strategies for teaching computer/technology concepts and skills within the context of classroom learning.	2. Identify and evaluate methods and strategies for teaching computer/technology concepts and skills within the context of classroom learning and coordinate dissemination of best practices at the district/state/regional level.
	3. Assist teachers as they use technology resources and strategies to support the diverse needs of learners including adaptive and assistive technologies.	3. Stay abreast of current technology resources and strategies to support the diverse needs of learners including adaptive and assistive technologies and disseminate information to teachers.
B. Apply current research on teaching and learning with technology when planning learning environments and experiences.	B. Apply current research on teaching and learning with technology when planning learning environments and experiences.	B. Apply current research on teaching and learning with technology when planning learning environments and experiences.
	1. Assist teachers as they apply current research on teaching and learning with technology when planning learning environments and experiences.	1. Locate and evaluate current research on teaching and learning with technology when planning learning environments and experiences.
C. Identify and locate technology resources and evaluate them for accuracy and suitability.	C. Identify and locate technology resources and evaluate them for accuracy and suitability.	C. Identify and locate technology resources and evaluate them for accuracy and suitability.
	1. Assist teachers as they identify and locate technology resources and evaluate them for accuracy and suitability based on district and state standards.	1. Identify technology resources and evaluate them for accuracy and suitability based on the content standards.
	2. Model technology integration using resources that reflect content standards.	2. Provide ongoing appropriate professional development to disseminate the use of technology resources that reflect content standards.
D. Plan for the management of technology resources within the context of learning activities.	D. Plan for the management of technology resources within the context of learning activities.	D. Plan for the management of technology resources within the context of learning activities.
	1. Provide teachers with options for the management of technology resources within the context of learning activities.	1. Identify and evaluate options for the management of technology resources within the context of learning activities.
E. Plan strategies to manage student learning in a technology-enhanced environment.	E. Plan strategies to manage student learning in a technology-enhanced environment.	E. Plan strategies to manage student learning in a technology-enhanced environment.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	1. Provide teachers with a variety of strategies to use to manage student learning in a technology-enhanced environment and support them as they implement the strategies.	1. Continually evaluate a variety of strategies to manage student learning in a technology-enhanced environment and disseminate through professional development activities.
F. Identify and apply instructional design principles associated with the development of technology resources.	F. Identify and apply instructional design principles associated with the development of technology resources.	F. Identify and apply instructional design principles associated with the development of technology resources.
	1. Assist teachers as they identify and apply instructional design principles associated with the development of technology resources.	1. Identify and evaluate instructional design principles associated with the development of technology resources.
NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
III. Teaching, Learning, and the Curriculum. Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. Teachers:	TF-III. Teaching, Learning, and the Curriculum. Educational technology facilitators apply and implement curriculum plans that include methods and strategies for utilizing technology to maximize student learning. Educational technology facilitators:	TL-III. Teaching, Learning, and the Curriculum. Educational technology leaders model, design, and disseminate curriculum plans that include methods and strategies for applying technology to maximize student learning. Educational technology leaders will:
A. Plan and implement technology-enhanced experiences that address best practices research and support content standards and student technology standards.	A. Facilitate technology-enhanced experiences that address content standards and student technology standards.	A. Facilitate technology-enhanced experiences that address content standards and student technology standards.
	1. Use methods and strategies for teaching concepts and skills that support integration of technology productivity tools (refer to NETS for Students).	1. Design methods and strategies for teaching concepts and skills that support integration of technology productivity tools (refer to NETS for Students).
	2. Use and apply major research findings and trends related to the use of technology in education to support integration throughout the curriculum.	2. Design methods for teaching concepts and skills that support integration of communication tools (refer to NETS for Students).
	3. Use methods and strategies for teaching concepts and skills that support integration of research tools (refer to NETS for Students).	3. Design methods and strategies for teaching concepts and skills that support integration of research tools (NETS refer to for Students).
	4. Use methods and strategies for teaching concepts and skills that support integration of problem solving/ decision-making tools (refer to NETS for Students).	4. Design methods and model strategies for teaching concepts and skills that support integration of problem solving/ decision-making tools (refer to NETS for Students).
	5. Use methods and strategies for teaching concepts and skills that support use of media-based tools such as television, audio, print media, and graphics.	5. Design methods and model strategies for teaching concepts and skills that support use of media-based tools such as television, audio, print media, and graphics.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	6. Use and describe methods and strategies for teaching concepts and skills that support use of distance learning systems appropriate in a school environment.	6. Evaluate methods and strategies for teaching concepts and skills that support use of distance learning systems appropriate in a school environment.
	7. Use methods for teaching concepts and skills that support use of web-based and non web-based authoring tools in a school environment.	7. Design methods and model strategies for teaching concepts and skills that support use of web-based and non web-based authoring tools in a school environment.
B. Use technology to support learner-centered strategies that address the diverse needs of students.	B. Use technology to support learner-centered strategies that address the diverse needs of students.	**B. Use technology to support learner-centered strategies that address the diverse needs of students.**
	1. Use methods and strategies for integrating technology resources that support the needs of diverse learners including adaptive and assistive technology.	1. Design methods and strategies for integrating technology resources that support the needs of diverse learners including adaptive and assistive technology.
C. Apply technology to develop students' higher order skills and creativity.	C. Apply technology to demonstrate students' higher order skills and creativity.	C. Apply technology to develop students' higher order skills and creativity.
	1. Use methods and facilitate strategies for teaching problem solving principles and skills using technology resources.	1. Design methods and model strategies for teaching hypermedia development, scripting, and/or computer programming, in a problem-solving context in the school environment.
D. Manage student-learning activities in a technology-enhanced environment.	D. Manage student-learning activities in a technology-enhanced environment.	D. Manage student-learning activities in a technology-enhanced environment.
	1. Use methods and classroom management strategies for teaching technology concepts and skills in individual, small group, classroom, and/or lab settings.	1. Design methods and model classroom management strategies for teaching technology concepts and skills used in P-12 environments.
E. Use current research and district/region/state/national content and technology standards to build lessons and units of instruction.	E. Use current research and district/region/state/national content and technology standards to build lessons and units of instruction.	E. Use current research and district/region/state/national content and technology standards to build lessons and units of instruction.
	1. Describe and identify curricular methods and strategies that are aligned with district/region/state/national content and technology standards.	1. Disseminate curricular methods and strategies that are aligned with district/region/state/national content and technology standards.
	2. Use major research findings and trends related to the use of technology in education to support integration throughout the curriculum.	2. Investigate major research findings and trends related to the use of technology in education to support integration throughout the curriculum.
IV. Assessment and Evaluation. Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies. Teachers:	TF-IV. Assessment and Evaluation. Educational Technology facilitators apply technology to facilitate a variety of effective assessment and evaluation strategies. Educational technology facilitators:	TL-IV. Educational technology leaders communicate research on the use of technology to implement effective assessment and evaluation strategies. Educational technology leaders:
A. Apply technology in assessing student learning of subject matter using a variety of assessment techniques.	A. Apply technology in assessing student learning of subject matter using a variety of assessment techniques.	A. Apply technology in assessing student learning of subject matter using a variety of assessment techniques.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	1. Model the use of technology tools to assess student learning of subject matter using a variety of assessment techniques.	1. Facilitate the development of a variety of techniques to use technology to assess student learning of subject matter.
	2. Assist teachers in using technology to improve learning and instruction through the evaluation and assessment of artifacts and data.	2. Provide technology resources for assessment and evaluation of artifacts and data.
B. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.	B. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.	B. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.
	1. Guide teachers as they use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.	1. Identify and procure technology resources to aid in analysis and interpretation of data.
C. Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.	C. Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.	C. Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.
	1. Assist teachers in using recommended evaluation strategies for improving students' use of technology resources for learning, communication, and productivity.	1. Design strategies and methods for evaluating the effectiveness of technology resources for learning, communication, and productivity.
	2. Examine and apply the results of a research project that includes evaluating the use of a specific technology in a P-12 environment.	2. Conduct a research project that includes evaluating the use of a specific technology in a P-12 environment.
NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
V. Productivity and Professional Practice. Teachers use technology to enhance their productivity and professional practice. Teachers:	TF-V. Productivity and Professional Practice. Educational technology facilitators apply technology to enhance and improve personal productivity and professional practice. Educational technology facilitators:	**TL-V. Productivity and Professional Practice. Educational technology leaders design, develop, evaluate and model products created using technology resources to improve and enhance their productivity and professional practice. Educational technology leaders:**
A. Use technology resources to engage in ongoing professional development and lifelong learning.	A. Use technology resources to engage in ongoing professional development and lifelong learning.	**A. Use technology resources to engage in ongoing professional development and lifelong learning.**
	1. Identify resources and participate in professional development activities and professional technology organizations to support ongoing professional growth related to technology.	1. Design, prepare, and conduct professional development activities to present at the school/district level and at professional technology conferences to support ongoing professional growth related to technology.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	2. Disseminate information on district-wide policies for professional growth opportunities for staff, faculty, and administrators.	2. Plan and implement policies that support district-wide professional growth opportunities for staff, faculty, and administrators.
B. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.	B. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.	**B. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.**
	1. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.	1. Based on evaluations make recommendations for changes in professional practices regarding the use of technology in support of student learning.
C. Apply technology to increase productivity.	C. Apply technology to increase productivity.	C. Apply technology to increase productivity.
	1. Model advanced features of word processing, desktop publishing, graphics programs, and utilities to develop professional products.	1. Model the integration of data from multiple software applications using advanced features of applications such as word processing, database, spreadsheet, communication, and other tools into a product.
	2. Assist others in locating, selecting, capturing, and integrating video and digital images, in varying formats for use in presentations, publications, and/or other products.	2. Create multimedia presentations integrated with multiple types of data using advanced features of a presentation tool and model them to district staff using computer projection systems.
	3. Demonstrate the use of specific-purpose electronic devices (such as graphing calculators, language translators, scientific probeware, or electronic thesaurus) in content areas.	3. Document and assess field-based experiences and observations using specific-purpose electronic devices.
	4. Use a variety of distance learning systems and use at least one to support personal and professional development.	4. Use distance learning delivery systems to conduct and provide professional development opportunities for students, teachers, administrators, and staff.
	5. Use instructional design principles to develop hypermedia and multimedia products to support personal and professional development.	5. Apply instructional design principles to develop and analyze substantive interactive multimedia computer-based instructional products.
	6. Select appropriate tools for communicating concepts, conducting research, and solving problems for an intended audience and purpose.	6. Design and practice strategies for testing functions and evaluating technology use effectiveness of instructional products that were developed using multiple technology tools.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	7. Use examples of emerging programming, authoring, or problem solving environments that support personal and professional development.	7. Analyze examples of emerging programming, authoring or problem solving environments that support personal and professional development, and make recommendations for integration at school/district level.
	8. Set and manipulate preferences, defaults, and other selectable features of operating systems and productivity tool programs commonly found in P-12 schools.	8. Analyze and modify the features and preferences of major operating systems and/or productivity tool programs when developing products to solve problems encountered with their operation and/or to enhance their capability.
D. Use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.	D. Use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.	D. Use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.
	1. Model the use of telecommunications tools and resources for information sharing, remote information access, and multimedia/hypermedia publishing in order to nurture student learning.	1. Model and implement the use of telecommunications tools and resources to foster and support information sharing, remote information access, and communication between students, school staff, parents, and local community.
	2. Communicate with colleagues and discuss current research to support instruction, using applications including electronic mail, online conferencing, and web browsers.	2. Organize, coordinate, and participate in an online learning community related to the use of technology to support learning.
	3. Participate in online collaborative curricular projects and team activities to build bodies of knowledge around specific topics.	3. Organize and coordinate online collaborative curricular projects with corresponding team activities/responsibilities to build bodies of knowledge around specific topics.
	4. Design and maintain Web pages and sites that support communication between the school and community.	4. Design, modify, maintain, and facilitate the development of Web pages and sites that support communication and information access between the entire school district and local/state/national/ international communities.
NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
VI. Social, Ethical, Legal, and Human Issues. Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply that understanding in practice. Teachers:	TF-VI. Social, Ethical, Legal, and Human Issues. Educational technology facilitators understand the social, ethical, legal, and human issues surrounding the use of technology in P-12 schools and assist teachers in applying that understanding in their practice. Educational technology facilitators:	**TL-VI. Social, Ethical, Legal, and Human Issues. Educational technology leaders understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and develop programs facilitating application of that understanding in practice throughout their district/ region/state. Educational technology leaders:**
A. Model and teach legal and ethical practice related to technology use.	A. Model and teach legal and ethical practice related to technology use.	A. Model and teach legal and ethical practice related to technology use.
	1. Develop strategies and provide professional development at the school/classroom level for teaching social, ethical, and legal issues and responsible use of technology.	1. Establish and communicate clear rules, policies, and procedures to support legal and ethical use of technologies at the district/ region/state levels.
	2. Assist others in summarizing copyright laws related to use of images, music, video, and other digital resources in varying formats.	2. Implement a plan for documenting adherence to copyright laws.
B. Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.	B. Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.	B. Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.
	1. Assist teachers in selecting and applying appropriate technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.	1. Communicate research on best practices related to applying appropriate technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.
	2. Identify, classify, and recommend adaptive/assistive hardware and software for students and teachers with special needs and assist in procurement and implementation.	2. Develop policies and provide professional development related to acquisition and use of appropriate adaptive/assistive hardware and software for students and teachers with special needs.
C. Identify and use technology resources that affirm diversity	C. Identify and use technology resources that affirm diversity.	C. Identify and use technology resources that affirm diversity.
	1. Assist teachers in selecting and applying appropriate technology resources to affirm diversity and address cultural and language differences.	1. Communicate research on best practices related to applying appropriate technology resources to affirm diversity and address cultural and language differences.
D. Promote safe and healthy use of technology resources.	D. Promote safe and healthy use of technology resources.	D. Promote safe and healthy use of technology resources.
	1. Assist teachers in selecting and applying appropriate technology resources to promote safe and healthy use of technology.	1. Communicate research and establish policies to promote safe and healthy use of technology.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
E. Facilitate equitable access to technology resources for all students.	E. Facilitate equitable access to technology resources for all students.	E. Facilitate equitable access to technology resources for all students.
	1. Develop a summary of effective school policies and classroom management strategies for achieving equitable access to technology resources for students and teachers.	1. Use research findings in establishing policy and implementation strategies to promote equitable access to technology resources for students and teachers.
	TF-VII. Procedures, Policies, Planning and Budgeting for Technology Environments. Educational technology facilitators promote the development and implementation of technology infrastructure, procedures, policies, plans, and budgets for P-12 schools. Educational technology facilitators:	**TL-VII. Procedures, Policies, Planning, and Budgeting for Technology Environments. Educational technology leaders coordinate development and direct implementation of technology infrastructure procedures, policies, plans, and budgets for P-12 schools. Educational technology leaders:**
	A. Use the school technology facilities and resources to implement classroom instruction.	A. Use the school technology facilities and resources to implement classroom instruction.
	1. Use plans to configure software/computer/technology systems and related peripherals in laboratory, classroom cluster, and other appropriate instructional arrangements.	1. Develop plans to configure software/computer/technology systems and related peripherals in laboratory, classroom cluster, and other appropriate instructional arrangements.
	2. Use local mass storage devices and media to store and retrieve information and resources.	2. Install local mass storage devices and media to store and retrieve information and resources.
	3. Discuss issues related to selecting, installing, and maintaining wide area networks (WAN) for school districts.	3. Prioritize issues related to selecting, installing, and maintaining wide area networks (WAN) for school districts, and facilitate integration of technology infrastructure with the WAN.
	4. Model integration of software used in classroom and administrative settings including productivity tools, information access/telecommunication tools, multimedia/hypermedia tools, school management tools, evaluation/portfolio tools, and computer-based instruction.	4. Manage software used in classroom and administrative settings including productivity tools, information access/telecommunication tools, multimedia/hypermedia tools, school management tools, evaluation/portfolio tools, and computer-based instruction.
	5. Utilize methods of installation, maintenance, inventory, and management of software libraries.	5. Evaluate methods of installation, maintenance, inventory, and management of software libraries.
	6. Use and apply strategies for troubleshooting and maintaining various hardware/software configurations found in school settings.	6. Develop and disseminate strategies for troubleshooting and maintaining various hardware/software configurations found in school settings.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	7. Utilize network software packages used to operate a computer network system.	7. Select network software packages used to operate a computer network system and/or local area network (LAN).
	8. Work with technology support personnel to maximize the use of technology resources by administrators, teachers, and students to improve student learning.	8. Analyze needs for technology support personnel to manage school/district technology resources and maximize use by administrators, teachers, and students to improve student learning.
	B. Follow procedures and guidelines used in planning and purchasing technology resources.	B. Follow procedures and guidelines used in planning and purchasing technology resources.
	1. Identify instructional software to support and enhance the school curriculum and develop recommendations for purchase.	1. Investigate purchasing strategies and procedures for acquiring administrative and instructional software for educational settings.
	2. Discuss and apply guidelines for budget planning and management procedures related to educational computing and technology facilities and resources.	2. Develop and utilize guidelines for budget planning and management procedures related to educational computing and technology facilities and resources.
	3. Discuss and apply procedures related to troubleshooting and preventive maintenance on technology infrastructure.	3. Develop and disseminate a system for analyzing and implementing procedures related to troubleshooting and preventive maintenance on technology infrastructure.
	4. Apply current information involving facilities planning issues and computer related technologies.	4. Maintain and disseminate current information involving facilities planning issues and computer related technologies.
	5. Suggest policies and procedures concerning staging, scheduling, and security for managing computers/technology in a variety of school/laboratory/classroom settings.	5. Design and develop policies and procedures concerning staging, scheduling, and security for managing hardware, software, and related technologies in a variety of instructional and administrative school settings.
	6. Use distance and online learning facilities.	6. Research and recommend systems and processes for implementation of distance and online learning facilities and infrastructure.
	7. Describe and identify recommended specifications for purchasing technology systems in school settings.	7. Differentiate among specifications for purchasing technology systems in school settings.
	C. Participate in professional development opportunities related to management of school facilities, technology resources, and purchases.	C. Participate in professional development opportunities related to management of school facilities, technology resources, and purchases.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	1. Support technology professional development at the building/school level utilizing adult learning theory.	1. Implement technology professional development at the school/district level utilizing adult learning theory.
	TF-VIII. Leadership and Vision. Educational technology facilitators will contribute to the shared vision for campus integration of technology and foster an environment and culture conducive to the realization of the vision. Educational technology facilitators:	**TL-VIII. Leadership and Vision. Educational technology leaders will facilitate development of a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of the vision. Educational technology leaders:**
	A. Utilize school technology facilities and resources to implement classroom instruction.	A. Identify and apply educational and technology related research, the psychology of learning, and instructional design principles in guiding the use of computers and technology in education.
	1. Discuss and evaluate current research in educational technology.	1. Communicate and apply principles and practices of educational research in educational technology.
	B. Apply strategies for and knowledge of issues related to managing the change process in schools.	B. Apply strategies for and knowledge of issues related to managing the change process in schools.
	1. Discuss the history of technology use in schools.	1. Describe social and historical foundations of education and how they relate to the use of technology in schools.
	C. Apply effective group process skills.	C. Apply effective group process skills.
	1. Discuss the rationale for forming school partnerships to support technology integration and examine an existing partnership within a school setting.	1. Discuss issues relating to building collaborations, alliances, and partnerships involving educational technology initiatives.
	D. Lead in the development and evaluation of district technology planning and implementation.	D. Lead in the development and evaluation of district technology planning and implementation.
	1. Participate in cooperative group processes and identify the processes that were effective.	1. Design and lead in the implementation of an effective group process related to technology leadership or planning.
	2. Conduct an evaluation of a school technology environment.	2. Use evaluation findings to recommend modifications in technology implementations.
	3. Identify and discuss national, state, and local standards for integrating technology in the school environment.	3. Use national, state, and local standards to develop curriculum plans for integrating technology in the school environment.
	4. Describe curriculum activities or performances that meet national, state, and local technology standards.	4. Develop curriculum activities or performances that meet national, state, and local technology standards.
	5. Discuss issues related to developing a school technology plan.	5. Compare and evaluate district-level technology plans.

NETS Foundations -- Prerequisite Preparation	Educational Computing and Technology Facilitation (TF)	Educational Computing and Technology Leadership (TL)
	6. Discuss the elements of and strategies for developing a technology strategic plan.	6. Use strategic planning principles to lead and assist in the acquisition, implementation, and maintenance of technology resources.
	7. Examine issues related to hardware and software acquisition and management.	7. Plan, develop, and implement strategies and procedures for resource acquisition and management of technology-based systems including hardware and software.
	E. Engage in supervised field-based experiences with accomplished technology facilitators and/or directors.	E. Engage in supervised field-based experiences with accomplished technology facilitators and/or directors.
	1. Examine components needed for effective field-based experiences in instructional program development, professional development, facility and resource management, WAN/LAN/wireless systems, or managing change related to technology use in school-based settings.	1. Participate in a significant field-based activity involving experiences in instructional program development, professional development, facility and resource management, WAN/LAN/wireless systems, or managing change related to technology use in school-based settings.

Source: International Society for Technology in Education (June 26, 2000). New ISTE standards for teachers guide university programs.

Appendix N

STL Standards and Benchmarks

Standard 1. Students will develop an understanding of the characteristics and scope of technology.

Grade Level	Benchmarks In order to comprehend the scope of technology, students should learn that:	
K-2	A.	The natural world and human-made world are different.
	B.	All people use tools and techniques to help them do things.
3-5	C.	Things that are found in nature differ from things that are human-made in how they are produced and used.
	D.	Tools, materials, and skills are used to make things and carry out tasks.
	E.	Creative thinking and economic and cultural influences shape technological development.
6-8	F.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
	G.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.
	H.	Technology is closely linked to creativity, which has resulted in innovation.
	I.	Corporations can often create demand for a product by bringing it onto the market and advertising it.
9-12	J.	The nature and development of technological knowledge and processes are functions of the setting.
	K.	The rate of technological development and diffusion is increasing rapidly.
	L.	Inventions and innovations are the results of specific, goal-directed research.
	M.	Most development of technologies these days is driven by the profit motive and the market.

Standard 2. Students will develop an understanding of the core concepts of technology.

Grade Level	Benchmarks In order to comprehend the core concepts of technology, students should learn that:	
K-2	A.	Some systems are found in nature, and some are made by humans.
	B.	Systems have parts or components that work together to accomplish a goal.
	C.	Tools are simple objects that help humans complete tasks.
	D.	Different materials are used in making things.
	E.	People plan in order to get things done.
3-5	F.	A subsystem is a system that operates as a part of another system.

	G.	When parts of a system are missing, it may not work as planned.
	H.	Resources are the things needed to get a job done, such as tools and machines, materials, information, energy, people, capital, and time.
	I.	Tools are used to design, make, use, and assess technology.
	J.	Materials have many different properties.

Standard 2. Students will develop an understanding of the core concepts of technology (Continued).

	K.	Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.
	L.	Requirements are the limits to designing or making a product or system.
6-8	M.	Technological systems include input, processes, output, and at times, feedback.
	N.	Systems thinking involves considering how every part relates to others.
	O.	An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.
	P.	Technological systems can be connected to one another.
	Q.	Malfunctions of any part of a system may affect the function and quality of the system.
	R.	Requirements are the parameters placed on the development of a product or system.
	S.	Trade-off is a decision process recognizing the need for careful compromises among competing factors.
	T.	Different technologies involve different sets of processes.
	U.	Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its quality.
	V.	Controls are mechanisms or particular steps that people perform using information about the system that causes systems to change.
9-12	W.	Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.
	X.	Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.
	Y.	The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
	Z.	Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.
	AA.	Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
	BB.	Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.
	CC	New technologies create new processes.

	DD EE FF.	Quality control is a planned process to ensure that a product, service, or system meets established criteria.
		Management is the process of planning, organizing, and controlling work.
		Complex systems have many layers of controls and feedback loops to provide information.

Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Grade Level	Benchmarks *In order to appreciate the relationships among technologies, as well as with other fields of study, students should learn that:*	
K-2	A.	The study of technology uses many of the same ideas and skills as other subjects.
3-5	B.	Technologies are often combined.
	C.	Various relationships exist between technology and other fields of study.
6-8	D.	D. Technological systems often interact with one another.
	E.	A product, system, or environment developed for one setting may be applied to another setting.
	F.	Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.
9-12	G.	Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.
	H.	Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
	I.	Technological ideas are sometimes protected through the process of patenting.
	J.	Technological progress promotes the advancement of science and mathematics.

Standard 4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.

Grade Level	Benchmarks *In order to recognize the changes in society caused by the use of technology, students should learn that:*	
K-2	A.	The use of tools and machines can be helpful or harmful.
3-5	B.	When using technology, results can be good or bad.
	C.	The use of technology can have unintended consequences.
6-8	D.	The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.
	E.	Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.
	F.	The development and use of technology poses ethical issues.
	G.	Economic, political, and cultural issues are influenced by the development and use of technology.
9-12	H.	Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.

	I.	Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
	J.	Ethical considerations are important in the development, selection, and use of technologies.
	K.	The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.

Standard 5. Students will develop an understanding of the effects of technology on the environment.

Grade Level	Benchmarks *In order to discern the effects of technology on the environment, students should learn that:*	
K-2	A.	Some materials can be reused and/or recycled.
3-5	B.	Waste must be appropriately recycled or disposed of to prevent unnecessary harm to the environment.
	C.	The use of technology affects the environment in good and bad ways.
6-8	D.	The management of waste produced by technological systems is an important societal issue.
	E.	Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
	F.	Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
9-12	G.	Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.
	H.	When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.
	I.	With the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.
	J.	The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.
	K.	Humans devise technologies to reduce the negative consequences of other technologies.
	L.	Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.

Standard 6. Students will develop an understanding of the role of society in the development and use of technology.

Grade Level	Benchmarks *In order to realize the impact of society on technology, students should learn that:*	
K-2	A.	Products are made to meet individual needs and wants.
3-5	B.	Because people’s needs and wants change, new technologies are developed, and old ones are improved to meet those changes.

	C.	Individual, family, community, and economic concerns may expand or limit the development of technologies.
6-8	D.	Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.
	E.	The use of inventions and innovations has led to changes in society and the creation of new needs and wants.
	F.	Social and cultural priorities and values are reflected in technological devices.

Standard 6. Students will develop an understanding of the role of society in the development and use of technology (Continued).

	G.	Meeting societal expectations is the driving force behind the acceptance and use of products and systems.
9-12	H.	Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
	I.	The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.
	J.	A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.

Standard 7. Students will develop an understanding of the influence of technology on history.

Grade Level	Benchmarks *In order to be aware of the history of technology, students should learn that:*	
K-2	A.	The way people live and work has changed throughout history because of technology.
3-5	B.	People have made tools to provide food, to make clothing, and to protect themselves.
6-8	C.	Many inventions and innovations have evolved using slow and methodical processes of tests and refinements.
	D.	The specialization of function has been at the heart of many technological improvements.
	E.	The design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding of spatial relationships.
	F.	In the past, an invention or innovation was not usually developed with the knowledge of science.
9-12	G.	Most technological development has been evolutionary, the result of a series of refinements to a basic invention.
	H.	The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
	I.	Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.

	J.	Early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
	K.	The Iron Age was defined by the use of iron and steel as the primary materials for tools.
	L.	The Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society.

Standard 7. Students will develop an understanding of the influence of technology on history (Continued).

	M.	The Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology.
	N.	The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
	O.	The Information Age places emphasis on the processing and exchange of information.

Standard 8. Students will develop an understanding of the attributes of design.

Grade Level	Benchmarks *In order to realize the attributes of design, students should learn that:*	
K-2	A.	Everyone can design solutions to a problem.
	B.	Design is a creative process.
3-5	C.	The design process is a purposeful method of planning practical solutions to problems.
	D.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.
6-8	E.	Design is a creative planning process that leads to useful products and systems.
	F.	There is no perfect design.
	G.	Requirements for design are made up of criteria and constraints.
9-12	H.	The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
	I.	Design problems are seldom presented in a clearly defined form.
	J.	The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.
	K.	Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 9. Students will develop an understanding of engineering design.

Grade Level	Benchmarks *In order to comprehend engineering design, students should learn that:*	
K-2	A.	The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.
	B.	Expressing ideas to others verbally and through sketches and models is an important part of the design process.
3-5	C.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.
	D.	When designing an object, it is important to be creative and consider all ideas.
	E.	Models are used to communicate and test design ideas and processes.
6-8	F.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.
	G.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.
	H.	Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.
9-12	I.	Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.
	J.	Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
	K.	A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
	L.	The process of engineering design takes into account a number of factors.

Standard 9. Students will develop an understanding of engineering design (Continued).

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Grade Level	Benchmarks *In order to comprehend other problem-solving approaches, students should learn that:*	
K-2	A.	Asking questions and making observations helps a person to figure out how things work.
	B.	All products and systems are subject to failure. Many products and systems, however, can be fixed.
3-5	C.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.
	D.	Invention and innovation are creative ways to turn ideas into real things.
	E.	The process of experimentation, which is common in science, can also be used to solve technological problems.

6-8	F.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
	G.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.
	H.	Some technological problems are best solved through experimentation.
9-12	I.	Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving (Continued).

	J.	Technological problems must be researched before they can be solved.
	K.	Not all problems are technological, and not every problem can be solved using technology.
	L.	Many technological problems require a multidisciplinary approach.

Standard 11. Students will develop the abilities to apply the design process.

Grade Level	Benchmarks *As part of learning how to apply design processes, students should be able to:*	
K-2	A.	Brainstorm people's needs and wants and pick some problems that can be solved through the design process.
	B.	Build or construct an object using the design process.
	C.	Investigate how things are made and how they can be improved.
3-5	D.	Identify and collect information about everyday problems that can be solved by technology, and generate ideas and requirements for solving a problem.
	E.	The process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.
	F.	Test and evaluate the solutions for the design problem.
	G.	Improve the design solutions.
6-8	H.	Apply a design process to solve problems in and beyond the laboratory-classroom.
	I.	Specify criteria and constraints for the design.
	J.	Make two-dimensional and three-dimensional representations of the designed solution.
	K.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.
	L.	Make a product or system and document the solution.
9-12	M.	Identify the design problem to solve and decide whether or not to address it.
	N.	Identify criteria and constraints and determine how these will affect the design process.
	O.	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

	P.	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	Q.	Develop and produce a product or system using a design process.
	R.	Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

Standard 12. Students will develop the abilities to use and maintain technological products and systems.

Grade Level	Benchmarks *As part of learning how to use and maintain technological products and systems, students should be able to:*	
K-12	A.	Discover how things work.
	B.	Use hand tools correctly and safely and be able to name them correctly.
	C.	Recognize and use everyday symbols.
3-5	D.	Follow step-by-step directions to assemble a product.
	E.	Select and safely use tools, products, and systems for specific tasks.
	F.	Use computers to access and organize information.
	G.	Use common symbols, such as numbers and words, to communicate key ideas.
6-8	H.	Use information provided in manuals, protocols, or by experienced people to see and understand how things work.
	I.	Use tools, materials, and machines safely to diagnose, adjust, and repair systems.
	J.	Use computers and calculators in various applications.
	K.	Operate and maintain systems in order to achieve a given purpose.
9-12	L.	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
	M.	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	N.	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	O.	Operate systems so that they function in the way they were designed.
	P.	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.

Standard 13. Students will develop the abilities to assess the impact of products and systems.

Grade Level	Benchmarks *As part of learning how to assess the impact of products and systems, students should be able to:*	
K-2	A.	Collect information about everyday products and systems by asking questions.
	B.	Determine if the human use of a product or system creates positive or negative results.

3-5	C.	Compare, contrast, and classify collected information in order to identify patterns.
	D.	Investigate and assess the influence of a specific technology on the individual, family, community, and environment.
	E.	Examine the trade-offs of using a product or system and decide when it could be used.
6-8	F.	Design and use instruments to gather data.
	G.	Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.

Standard 13. Students will develop the abilities to assess the impact of products and systems (Continued).

	H.	Identify trends and monitor potential consequences of technological development.
	I.	Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
9-12	J.	Collect information and evaluate its quality.
	K.	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.
	L.	Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology.
	M.	Design forecasting techniques to evaluate the results of altering natural systems.

Standard 14. Students will develop an understanding of and be able to select and use medical technologies.

Grade Level	Benchmarks *In order to select, use, and understand medical technologies, students should learn that:*	
K-2	A.	Vaccinations protect people from getting certain diseases.
	B.	Medicine helps people who are sick to get better.
	C.	There are many products designed specifically to help people take care of themselves.
3-5	D.	Vaccines are designed to prevent diseases from developing and spreading; medicines are designed to relieve symptoms and stop diseases from developing.
	E.	Technological advances have made it possible to create new devices, to repair or replace certain parts of the body, and to provide a means for mobility.
	F.	Many tools and devices have been designed to help provide clues about health and to provide a safe environment.
6-8	G.	Advances and innovations in medical technologies are used to improve healthcare.
	H.	Sanitation processes used in the disposal of medical products help to protect people from harmful organisms and disease, and shape the ethics of medical safety.
	I.	The vaccines developed for use in immunization require specialized technologies to support environments in which a sufficient amount of vaccines is produced.
	J.	Genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups.

9-1	K.	Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.
	L.	Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.
	M.	The sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.

Standard 15. Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

Grade Level	Benchmarks *In order to select, use, and understand agricultural and related biotechnologies, students should learn that:*	
K-2	A.	The use of technologies in agriculture makes it possible for food to be available year round and to conserve resources.
	B.	There are many different tools necessary to control and make up the parts of an ecosystem.
3-5	C.	Artificial ecosystems are human-made environments that are designed to function as a unit and are comprised of humans, plants, and animals.
	D.	Most agricultural waste can be recycled.
	E.	Many processes used in agriculture require different procedures, products, or systems.
6-8	F.	Technological advances in agriculture directly affect the time and number of people required to produce food for a large population.
	G.	A wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.
	H.	Biotechnology applies the principles of biology to create commercial products or processes.
	I.	Artificial ecosystems are human-made complexes that replicate some aspects of the natural environment.
	J.	The development of refrigeration, freezing, dehydration, preservation, and irradiation provide long-term storage of food and reduce the health risks caused by tainted food.
9-12	K.	Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.
	L.	Biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.
	M.	Conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.

	N.	The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.

Standard 16. Students will develop an understanding of and be able to select and use energy and power technologies.

Grade Level	Benchmarks *In order to select, use, and understand energy and power technologies, students should learn that:*	
K-2	A.	Energy comes in many forms.
	B.	Energy should not be wasted.

Standard 16. Students will develop an understanding of and be able to select and use energy and power technologies (Continued).

3-5	C.	Energy comes in different forms.
	D.	Tools, machines, products, and systems use energy in order to do work.
6-8	E.	Energy is the capacity to do work.
	F.	Energy can be used to do work, using many processes.
	G.	Power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.
	H.	Power systems are used to drive and provide propulsion to other technological products and systems.
	I.	Much of the energy used in our environment is not used efficiently.
9-12	J.	Energy cannot be created nor destroyed; however, it can be converted from one form to another.
	K.	Energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.
	L.	It is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.
	M.	Energy resources can be renewable or nonrenewable.
	N.	Power systems must have a source of energy, a process, and loads.

Standard 17. Students will develop an understanding of and be able to select and use information and communication technologies.

Grade Level	Benchmarks *In order to select, use, and understand information and communication technologies, students should learn that:*	
K-2	A.	Information is data that has been organized.
	B.	Technology enables people to communicate by sending and receiving information over a distance.
	C.	People use symbols when they communicate by technology.
3-5	D.	The processing of information through the use of technology can be used to help humans make decisions and solve problems.
	E.	Information can be acquired and sent through a variety of technological sources, including print and electronic media.

	F.	Communication technology is the transfer of messages among people and/or machines over distances through the use of technology.
	G.	Letters, characters, icons, and signs are symbols that represent ideas, quantities, elements, and operations.
6-8	H.	Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.
	I.	Communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination.
	J.	The design of a message is influenced by such factors as intended audience, medium, purpose, and the nature of the message.
	K.	The use of symbols, measurements, and drawings promotes a clear communication by providing a common language to express ideas.

Standard 17. Students will develop an understanding of and be able to select and use information and communication technologies (Continued).

9-12	L.	Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.
	M.	Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.
	N.	Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.
	O.	Communication systems are made up of source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
	P.	There are many ways to communicate information, such as graphic and electronic means.
	Q.	Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

Standard 18. Students will develop an understanding of and be able to select and use transportation technologies.

Grade Level	Benchmarks *In order to select, use, and understand transportation technologies, students should learn that:*	
K-2	A.	A transportation system has many parts that work together to help people travel.
	B.	Vehicles move people or goods from one place to another in water, air or space, and on land.
	C.	Transportation vehicles need to be cared for to prolong their use.
3-5	D.	The use of transportation allows people and goods to be moved from place to place.
	E.	A transportation system may lose efficiency or fail if one part is missing or malfunctioning or if a subsystem is not working.
6-8	F.	Transporting people and goods involves a combination of individuals and vehicles.

	G.	Transportation vehicles are made up of subsystems, such as structural propulsion, suspension, guidance, control, and support, that must function together for a system to work effectively.
	H.	Governmental regulations often influence the design and operation of transportation systems.
	I.	Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

Standard 18. Students will develop an understanding of and be able to select and use transportation technologies (Continued).

9-12	J.	Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
	K.	Intermodalism is the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.
	L.	Transportation services and methods have led to a population that is regularly on the move.
	M.	The design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques.

Standard 19. Students will develop an understanding of and be able to select and use manufacturing technologies.

Grade Level	Benchmarks *In order to select, use, and understand manufacturing technologies, students should learn that:*	
K-2	A.	Manufacturing systems produce products in quantity.
	B.	Manufactured products are designed.
3-5	C.	Processing systems convert natural materials into products.
	D.	Manufacturing processes include designing products, gathering resources, and using tools to separate, form, and combine materials in order to produce products.
	E.	Manufacturing enterprises exist because of a consumption of goods.
6-8	F.	Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them.
	G.	Manufactured goods may be classified as durable and non-durable.
	H.	The manufacturing process includes the designing, development, making, and servicing of products and systems.
	I.	Chemical technologies are used to modify or alter chemical substances.
	J.	Materials must first be located before they can be extracted from the earth through such processes as harvesting, drilling, and mining.

	K.	Marketing a product involves informing the public about it as well as assisting in its sales and distribution.
9-12	L.	Servicing keeps products in good operating condition.
	M.	Materials have different qualities and may be classified as natural, synthetic, or mixed.
	N.	Durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time.
	O.	Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.
	P.	The interchangeability of parts increases the effectiveness of manufacturing processes.

Standard 19. Students will develop an understanding of and be able to select and use manufacturing technologies (Continued).

	Q.	Chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.
	R.	Marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.

Standard 20. Students will develop an understanding of and be able to select and use construction technologies.

Grade Level	Benchmarks *In order to select, use, and understand construction technologies, students should learn that:*	
K-2	A.	People live, work, and go to school in buildings, which are of different types: houses, apartments, office buildings, and schools.
	B.	The type of structure determines how the parts are put together.
3-5	C.	Modern communities are usually planned according to guidelines.
	D.	Structures need to be maintained.
	E.	Many systems are used in buildings.
6-8	F.	The selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost, climate, and function.
	G.	Structures rest on a foundation.
	H.	Some structures are temporary, while others are permanent.
	I.	Buildings generally contain a variety of subsystems.
9-12	J.	Infrastructure is the underlying base or basic framework of a system.
	K.	Structures are constructed using a variety of processes and procedures.
	L.	The design of structures includes a number of requirements.
	M.	Structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use.
	N.	Structures can include prefabricated materials.

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Appendix O

Advancing Excellence in Technological Literacy Standards (AETL)

Student Assessment Standards

Standard A-1: Assessment of student learning will be consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL).*

Guidelines for meeting Standard A-1 require that teachers consistently

A. Administer comprehensive planning and development across disciplines.
B. Incorporate comprehensive planning and development across grade levels.
C. Include cognitive learning elements for solving technological problems.
D. Include psychomotor learning elements for applying technology.
E. Guide student abilities to operate within the affective domain, utilizing perspective, empathy, and self assessment.

Standard A-2: Assessment of student learning will be explicitly matched to the intended purpose.

Guidelines for meeting Standard A-2 require that teachers consistently

A. Formulate a statement of purpose for assessment tools.
B. Identify and consider the intended audience in designing assessment tools and reporting assessment data.
C. Utilize fair and equitable student assessment methods.
D. Establish valid and reliable measurements that are reflective of classroom experiences.

Standard A-3: Assessment of student learning will be systematic and derived from research-based assessment principles.

Guidelines for meeting Standard A-3 require that teachers consistently

A. Remain current with research on student learning and assessment.

B. Devise a formative assessment plan.

C. Establish a summative assessment plan.

D. Facilitate enhancement of student learning.

E. Accommodate for student commonality and diversity.

F. Include students in the assessment process.

Standard A-4: Assessment of student learning will reflect practical contexts consistent with the nature of technology.

Guidelines for meeting Standard A-4 require that teachers consistently

A. Incorporate technological problem solving.

B. Include variety in technological content and performance-based methods.

C. Facilitate critical thinking and decision making.

D. Accommodate for modification to student assessment.

E. Utilize authentic assessment.

Standard A-5: Assessment of student learning will incorporate data collection for accountability, professional development, and program enhancement.

Guidelines for meeting Standard A-5 require that teachers consistently

A. Maintain data collection for accountability.

B. Use student assessment results to help guide professional development decisions.

C. Use student assessment results to help guide program enhancement decisions.

Professional Development Standards

Standard PD-1: Professional development will provide teachers with knowledge, abilities, and understanding consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL).*

Guidelines for meeting Standard PD-1 require that professional development providers consistently prepare teachers to

A. Understand the nature of technology.
B. Recognize the relationship between technology and society.
C. Know the attributes of design.
D. Develop abilities for a technological world.
E. Develop proficiency in the designed world.

Standard PD-2: Professional development will provide teachers with educational perspectives on students as learners of technology.

Guidelines for meeting Standard PD-2 require that professional development providers consistently prepare teachers to

A. Incorporate student commonality and diversity to enrich learning.
B. Provide cognitive, psychomotor, and affective learning opportunities.
C. Assist students in becoming effective learners.
D. Conduct and use research on how students learn technology.

Standard PD-3: Professional development will prepare teachers to design and evaluate technology curricula and programs.

Guidelines for meeting Standard PD-3 require that professional development providers consistently prepare teachers to

A. Design and evaluate curricula and programs that enable all students to attain technological literacy.
B. Design and evaluate curricula and programs across disciplines.

C. Design and evaluate curricula and programs across grade levels.

D. Design and evaluate curricula and programs using multiple sources.

Standard PD-4: Professional development will prepare teachers to use instructional strategies that enhance technology teaching, student learning, and student assessment.

Guidelines for meeting Standard PD-4 require that professional development providers consistently prepare teachers to

A. Coordinate instructional strategies with curricula.

B. Incorporate educational (instructional) technology.

C. Utilize student assessment.

Standard PD-5: Professional development will prepare teachers to design and manage learning environments that promote technological literacy.

Guidelines for meeting Standard PD-5 require that professional development providers consistently prepare teachers to

A. Design and manage learning environments that operate with sufficient resources.

B. Design and manage learning environments that encourage, motivate, and support student learning of technology.

C. Design and manage learning environments that accommodate student commonality and diversity.

D. Design and manage learning environments that reinforce student learning and teacher instruction.

E. Design and manage learning environments that are safe, appropriately designed, and well maintained.

F. Design and manage learning environments that are adaptable.

Standard PD-6: Professional development will prepare teachers to be responsible for their own continued professional growth.

Guidelines for meeting Standard PD-6 require that professional development providers consistently prepare teachers to

A. Assume commitment to self assessment and responsibility for continuous professional growth.
B. Establish a personal commitment to ethical behavior within the educational environment as well as in private life.
C. Facilitate collaboration with others.
D. Participate in professional organizations.
E. Serve as advisors for technology student organizations
F. Provide leadership in education.

Standard PD-7: Professional development providers will plan, implement, and evaluate the pre-service and in-service education of teachers.

Guidelines for meeting Standard PD-7 require that professional development providers consistently

A. Plan pre-service and in-service education for teachers.
B. Model teaching practices that teachers will be expected to use in their laboratory-classrooms.
C. Evaluate professional development to assure that the needs of teachers are being met.
D. Support technology teacher preparation programs that are consistent with state/ provincial/regional and national/federal accrediting guidelines.

E. Provide teacher preparation programs, leading to licensure, that are consistent with *AETL* and *STL.*

F. Provide in-service activities to enhance teacher understanding of technological content, instruction, and assessment.

G. Obtain regular funding for in-service professional development opportunities.

H. Create and implement mentoring activities at both in-service and pre-service levels.

Program Standards (For Teachers):

Standard P-1: Technology program development will be consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL)*.

Guidelines for meeting Standard P-1 require that the teacher(s) responsible for the technology program (s) consistently

A. Align program content with *STL*.

B. Align program content with school district, state/provincial/regional, and national/federal standards in other academic areas.

C. Plan and develop the program across disciplines.

D. Plan and develop the program across grade levels.

E. Assure that the program incorporates suitable cognitive, psychomotor, and affective learning elements.

F. Promote adaptability for program enhancement.

Standard P-2: Technology program implementation will facilitate technological literacy for all students.

Guidelines for meeting Standard P-2 require that the teacher(s) responsible for the technology program (s) consistently

A Provide instruction that is consistent with research on how students learn technology.

B. Provide instruction that is designed to meet curricular goals and student needs.

C. Design and implement curricula that enable all students to attain technological literacy.

D. Develop student leadership opportunities.

Standard P-3: Technology program evaluation will ensure and facilitate technological literacy for all students.

Guidelines for meeting Standard P-3 require that the teacher(s) responsible for the technology program (s) consistently

A. Develop and utilize evaluation that is consistent with standards and guidelines in "Program Standards."

B. Implement and use systematic, continuous evaluation.

C. Evaluate instruction on a regular basis.

D. Plan for program revision.

E. Accommodate for student commonality and diversity.

F. Utilize effective student assessment.

Standard P-4: Technology program learning environments will facilitate technological literacy for all students.

Guidelines for meeting Standard P-4 require that the teacher(s) responsible for the technology program (s) consistently

A. Create and manage learning environments that are supportive of student interactions and student abilities to question, inquire, design, invent, and innovate.

B. Create and manage learning environments that are up-to-date and adaptable.

C. Implement a written, comprehensive safety program.

D. Promote student development of knowledge and abilities that provides for the safe application of appropriate technological tools, machines, materials, and processes.
E. Verify that the number of students in the technology laboratory-classroom does not exceed its capacity.

Standard P-5: Technology program management will be provided by designated personnel at the school, school district, and state/provincial/regional levels.

Guidelines for meeting Standard P-5 require that the teacher(s) responsible for the management of the technology program (s) consistently

A. Develop and use action plans based on *STL*
B. Maintain data collection for accountability.
C. Market and promote the study of technology.

Program Standards For Administrators

Standard P-1: Technology program development will be consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL)*.

Guidelines for meeting Standard P-1 require that administrators responsible for establishing the cross curricular technology program consistently

A. Stipulate that content be aligned with STL.
B. Mandate instruction in the study of technology as part of the core educational experience for all students.
C. Advocate content that complements school district, state/provincial/regional, and national/federal standards in other academic areas.
D. Assure that the study of technology occurs across disciplines

E. Assure that the study of technology occurs across grade levels.

F. Promote adaptability to enhance the study of technology.

Standard P-2: Technology program implementation will facilitate technological literacy for all students.

Guidelines for meeting Standard P-2 require that the administrators responsible for establishing the cross-curricular technology program (s) consistently

A. Employ licensed teachers to deliver technology content.

B. Support sustained professional growth and development of all educators.

C. Encourage instruction that is consistent with research on how students learn technology.

D. Advocate instruction that is designed to meet curricular goals and student needs.

E. Commit to the recruitment of technologically competent teachers.

F. Encourage all teachers to develop student leadership opportunities.

Standard P-3: Technology program evaluation will ensure and facilitate technological literacy for all students.

Guidelines for meeting Standard P-3 require that administrators responsible for cross-curricular technology program (s) consistently

A. Assure evaluation is consistent with standards and guidelines in "Program Standards."

B. Employ systematic, continuous evaluation.

C. Encourage evaluation of instruction on a regular basis.

D. Plan for program revision.

Standard P-4: Technology program learning environments will facilitate technological literacy for all students.

Guidelines for meeting Standard P-4 require that administrators responsible for establishing the cross-curricular technology program (s) consistently

A. Provide learning environments that are designed to facilitate delivery of STL and satisfy "Program Standards."
B. Provide learning environments that are safe up-to-date, and adaptable.
C. Ensure that the number of students in a dedicated technology laboratory-classroom does not exceed its capacity.
D. Provide elementary school classrooms with adequate physical space for teaching technology.
E. Provide dedicated technology laboratory-classrooms in middle and high schools with a minimum allotment of 100 square feet per pupil, inclusive of safe ancillary space.

Standard P-5: Technology program management will be provided by designated personnel at the school, school district, and state/provincial/regional levels.

Guidelines for meeting Standard P-5 require that administrators responsible for the management of the cross-curricular technology program (s) consistently

A. Develop and use action plans based on STL.
B. Maintain data collection for accountability.
C. Market and promote the study of technology.
D. Provide funding, support, and resources to accomplish missions, goals, and curricular objectives.
E. Align technology programs with state/provincial/regional accreditation systems.
F. Establish articulated and integrated technology programs district wide.
G. Establish and utilize a management system.

H. Support professional technology organization engagement by teachers and management personnel.

I. Provide resources and opportunities to support technology teachers and other content area teachers in the teaching and learning process.

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Appendix P
Number of Eight-Method Combinations

Assessment Method Combination Order From Left to Right

1. Computer-based Assessment
2. Performance Assessment,
3. Portfolio,
4. Paper-Pencil,
5. Workshops,
6. College Courses,
7. Mentoring,
8. Signed Demonstrated Proficiency

Count of Number of Methods Used	
Number of Methods Used	School Divisions
1	9
2	14
3	13
4	28
5	17
6	13
7	10
8	0
Total	104

	Assessment Method Combination	Total
1	00000100	3
2	00001000	1
3	00001100	3
4	00001101	2
5	00001111	2
6	00100000	4
7	00100001	3
8	00100100	1
9	00100101	1
10	00101001	2
11	00101011	2
12	00101100	3
13	00101101	5
14	00101110	3
15	00101111	3
16	00110001	1
17	01001000	2
18	01001011	1
19	01001110	2
20	01010001	1
21	01011001	2
22	01011010	1
23	01011100	1
24	01011111	2
25	01100000	3
26	01101001	3
27	01101100	1
28	01101101	4
29	01101110	1
30	01101111	5
31	01110110	1
32	01111100	1
33	01111111	2
34	10000000	1
35	10000100	1
36	10001000	1
37	10001100	2
38	10001111	2
39	10011101	1
40	10100101	1
41	10101010	1
42	10101100	1
43	10101111	1
44	10110001	1
45	11000100	1
46	11001010	1
47	11001101	2
48	11001110	2
49	11001111	1
50	11011101	1
51	11011110	1
52	11101101	1
53	11101110	1
54	11101111	8
	blank	28
	Grand Total	132

Appendix Q

Descriptive Survey Responses on the Computer Based Assessment Method Stated In Context (SIC)

- A Test Out option for Standards A, B, C, and D has been constructed. Each standard is tested individually (15 multiple-choice questions). The test is proctored. The test is delivered via our Blackboard courseware server. An individual who fails any part of the test must demonstrate proficiency using one of the other options.
- Computer-based assessment is required for all participants in our Technology Integration Education (TIE) program. These assessments are based on the TIE curriculum, which addresses the Virginia Technology Standards for Instructional Personnel. They serve as benchmarks of progress in knowledge and skill acquisition. We presently use Blackboard.com as a test administration site. Participants can take and retake practice tests in preparation for proctored tests. The test items are true/false, multiple choice, and essay questions. A test typically consists of 20 questions. Feedback for questions missed on practice tests includes a hyperlink to the relevant chapter of the training manual. The final assessment for each module in the training manual is proctored. The one exception to this model is the assessment for the module on Appropriate and Ethical Use of Technology, which is a Web Quest that the participant to answer four essay questions.
- Teachers complete a multiple-choice assessment to determine content knowledge. Teachers then complete as many of the required competencies as possible via technology and attach copies to an email and send them to their evaluators.
- Used on selected proficiencies, e.g., terminology. When requested, it is used on individual "test out" basis for proficiencies like word processing.
- Building level administrators determine the level of proficiency for teachers. Teacher has to certify their competency and how they use technology in their classroom.
- On line courses
- A website was developed containing all of the information that an individual would need to master the Technology Standards. When the individual felt that they were ready to take the test, they signed up online. The individual came to Central Office to complete the online test which was created from the information on the website. The person received their score immediately to let them know if they had passed the test or not.
- Only for Standard 2 (vocabulary) Score is printed and included in the portfolio. This is an optional method.

- I would like to set-up something that would be used in conjunction with our portfolios, but cannot afford the BlackBoard software that could be used to set this up.
- Teachers who wish to demonstrate computer literacy (to avoid taking in-service classes) take the opt-out test. This test requires them to take written tests on items such as knowledge of technical vocabulary, parts of computers, ethical issues, legal issues, etc. However, the second part of this test is performance based, and it requires practical applications, including setting up databases, designing brochures, evaluating software packages, formatting disks, preparing PowerPoint presentations, etc. These practical applications take place in the testing center with a technology coordinator evaluating work. The test-out usually takes multiple sessions. I say it is cost effective because the assessor is paid through a grant. Even if it weren't, the cost is still minimal, as the assessor receives only an hourly rate and the teachers testing out do so on their own time after school.
- CBT exams were given to instructional staff on the components of the MS Office suite and the Internet over a three-year period. This was used to establish skills-based knowledge.
- We had a test that we used for part of the competencies--It was one of multiple options that teachers had to complete the operational portion of the competencies. The test was not widely used. Most teachers found it easier to complete the operational competencies another way.
- Teachers keep electronic portfolio of technology competencies mandated by state department and certain skills added on by the school division
- Using pre-defined Computer Based Application Templates and Hands on Training.
- We have a test for Standard 2 and for Standard 8.
- Teachers took a hands-on three-hour test that included each component of TSIP. The Local Community College proctored the test.
- An ASP solution is used for teachers to engage in a self-paced self assessed approach to the Technology Competencies
- All licensed staff hired during the 2002/03 school years was required to take a computer-based assessment test developed by ----Community College. Those passing the assessment were awarded certificates of TSIP competency. Remediation classes were held for those needing additional help to ensure proficiency of the standard(s) that were not passed. Upon successful completion of the classes, a certificate was issued by --C.
- ---Community College devised a plan for our school system that comprised a test on the various components of the technology standards.
- We have reviewed a lot of computer based products even some of the most highly

recommended had one major flaw...they were very subjective. We discovered over four years ago that this subjective nature turned teachers off and was not a good way to measure their skills.

- We have a Blackboard module set up for teachers to deposit samples of their work. This module includes a test that they take. Not cost effective because our license to Blackboard is $5000 per year. We are moving to Microsoft Class Server sometime soon.
- Employees had to demonstrate proficiency in creating Word and Excel documents, in creating mail merge lists in Word, in formatting spreadsheet, and in other common tasks.
- It is not a test. We have a self-assessment, which is done online. The user then prints the document out, has the principal certify as to its validity (by signature), and this is submitted to the Personnel Office.
- We have only done this the last 2 years. The test was developed by a local community college and administered by them. A brief review is given before the test
- The assessment is self-administered and then certified by an administrator.
- ActNow provided a pretest, tutorial and testing component. The testing phase is proctored and test results are signed off and submitted to school board office.
- This service was purchased from a community college to keep the assessment as objective as possible. Because the community college is a state supported institution the cost was very reasonable.
- Accelerated Reader/Math, STAR Reader/Math, Edutest
- Professional staff completes an on-line Self Evaluation Survey. This lets us know two things: 1) Who is proficient and able to teach the skills; 2) Who needs help or training.
- This is an option (test-out) available for TSIP 1-2 in our division.
- We do have a hands-on assessment that covers basic computer use (opening closing, positioning windows, printing, saving, mouse use, etc.) but not a computer-based assessment. Such a tool could be useful. Such a tool could also be useful in the soon to be here NCLB 8th grade assessments for students now that the SOL is no longer. We need a tool that measures hands on proficiency, including basic applications. Multiple choice is less than an ideal tool for measuring proficiency.
- --Community College developed a computer-based assessment. They give the test and compile the results for our use.
- The proficiency results are applied to an electronic portfolio.

- Three 20-question tests must be passed with an 80% proficiency rate on each. Each test is independent of the others. There is a test bank of over 300 questions; therefore, making each test different with 20 randomly selected questions.

Appendix R

Descriptive Survey Responses on the Performance Assessment Method Stated In Context (SIC)

- Is Performance Assessment on the computer a method your school division uses to assess teachers' proficiency on the technology standards? (The individual produces assignments specified by the school division on the computer and sends it electronically to a designated place or teachers are asked to perform several specified tasks on the computer). Briefly describe your method

- Every participant is required either to submit technology products - word processing, spreadsheet, database, slide show, Web page - that demonstrate proficiency in each of these areas or to integrate them into her/his final project. (See below.)
- Same as above
- Teachers are asked to create a simple word-processed document, a simple spreadsheet, and a simple database. These skills are actually demonstrated for a designated person at each school site. These samples are printed out and each teacher keeps their own in a portfolio to submit if requested or when applying for recertification. Our method seems to be a combination of performance and portfolio assessments. This plan for technology competency was created to be simple since so many teachers have hardware with limited capability. Teachers cannot be asked to do something for which they do not have the tools to do it.
- Faculty/staff complete a varied amount of assignments and either demonstrate for a coordinator or submit them to a coordinator
- Segment of professional target for annual performance review
- Teachers are required to complete several tasks in the presence of a technology coordinator or building administrator
- Used on "test out" basis when requested by individual teacher.
- In the past, teachers have had to demonstrate use of e-mail, spreadsheets, etc.

- Part of the computer-based assessment was performance based. Individuals were required to use their e-mail and create an SOL based lesson plan incorporating technology. This lesson plan was posted to a division website of lesson plans and the lesson plan had to be observed by an administrator.
- We use an assessment tool developed and administered by our local community college.
- While most of our assessments are portfolio based, a number of them also demand that the

users send e-mail with attachments to illustrate that they can perform that skill. Cost efficient? I guess...I get all the e-mail and print it out to be put in their portfolio!

- Teachers who do not feel confident enough to take the opt-out test, take in-service classes. These classes teach basic computer skills and incorporate all of the requirements for computer literacy. At the end of each session, teachers are required to demonstrate proficiency by completing a project. This is assessed by the instructor. Those who pass are certified computer literate. Those who do not pass must retake the classes.
- Disregard grade given (could not clear individual line items from this electronic survey). Began to type answer for "portfolio" response here.
- This method is used for some of the Technology Standards for Instructional Personnel- as an example- the ability to send email attachments.
- One option we give teachers to prove proficiency is to participate in an online class where assignments are completed based on specified rubrics. Many of our teachers have completed the course entitled "TECHniques for Teachers". In our case, technology resource teachers acted as facilitators and grade the assignments as part of their job expectations. However, if we did this option with all teachers participating the cost and time efficiency of grading the assignments would not be efficient.
- Teachers complete a technology portfolio
- We have divided the skills into 3 levels. All three levels require different projects with the third level requiring a video of the teacher using technology effectively in the classroom. I used the Tech Literacy money and now the Ed Tech money to pay a person at each school (2 at the sec. level) to monitor this and help teachers. This has been one of the best projects we have ever work with for staff development.
- Individuals demonstrate assessments at a computer and are checked off on each proficiency.
- Each teacher maintains records electronically and passes to school technology coordinator who then sends confirmation to central office staff
- A performance assessment is given as an opt-out test for incoming teachers to our school system. This allows us to determine who needs training and provides evidence of proficiency for those that do not need training. This evidence is placed in the teachers technology portfolio.
- Using typing applications, productivity applications, and e-mail messaging. Technology training for staff via WAN framework involves the understanding and utilization of technology resources across the Internet and the entire network including the school division.
- This method is used in certain fundamental areas such as use of Word Processing, spreadsheets and databases.

- Teachers must demonstrate skills for the trainer that is checking them off. A Competency Checklist is provided.
- Instructional technology specialists in each school train teachers on clearly defined criteria. Teachers demonstrate the learning.
- We use this for Standard 1, troubleshooting.
- Although we strive to make each component applicable to a teacher's discipline, this is impossible for some. Teachers do learn the processes, but some would be hard pressed to produce it again in 3 month.
- In performance assessment there is always the question of exactly "who" did the work. There was a situation where a power point presentation was actually done by a student.
- Same as above
- The Tech training / skills check includes separate skills check on 1. General computer use including use of CD-ROM, Floppy disk, printing, etc. 2. Making and using spreadsheets, 3. Making and using databases, 4. making and showing a presentation, 5, editing a word processing document and 6. Writing a lesson plan that includes technology.7 doing an Internet project
- Same as above-- Class Server solution looks more promising. This assessment format is new this year, taking the place of checklists of skills kept by school-based trainers.
- Online Courses
- Teachers evaluate web sites and/or software and e-mail a paragraph summary to their administrator.
- Employees are required to create assignments using Word and Excel, save those documents to a home directory on their schools file server, and also to e-mail file attachments to their instructor.
- Teachers had to complete various tasks (TSIP 1, 3, & 4) on the computer. Start-up, copy files, access software on school LAN; type, edit & print word processing, insert graphic; create database, make labels; create spreadsheet, create a graph; use internet to locate info, and send email & attachment.
- Use of grants such as TLC Grant (Technology Literacy Challenge Grant)
- We developed an assessment package (portfolio) to be completed by each teacher. The completed assessments are emailed to our Inst. Tech. Coordinator who checks them and records completion in a database.

- Teachers are asked to perform basic computer skills - setup/open/save/print and simple word processing, spreadsheet and database functions in a lab setting under the supervision of the technology evaluator.
- This is an option (test-out) available for TSIP 3-4 in our division.
- See above. Authentic assessment.
- Our Lifelong Learning Center provides a variety of productivity and applications courses, many of which are tied to TSIPs. Each class requires an exit assessment.
- We use this for teachers who do not initially pass the standards tests or for those who want to use an alternative method for some reason.
- Electronic portfolio.

Appendix S

Descriptive Survey Responses on the Portfolio Assessment Method Stated In Context (SIC)

Script # 3. Is the Portfolio Assessment a method your school division uses to assess teachers' proficiency on the technology standards? (The individual produces assignments specified by the school division on the computer, prints it out, and keeps it in a notebook or submits a disk to the appropriate school official.) Briefly describe the portfolio assessment method:

- 8 standards with 2-4 assignments required
- Each portfolio contains a series of skills checklists that correspond to the skills required to meet standards A-D. Each skills checklist is initialed by someone (peer, colleague, instructor, administrator) who witnesses the performance of the skills. Standards E-H require that the portfolio presenter create two lesson plans and select four additional products (from a list of about a dozen items) that demonstrate proficiency of the skills of utilizing technology in an instructional setting.
- The portfolio consists of the participant's final project (a technology enhanced lesson plan that includes at least 4 of 16 identified technology applications) and, in some cases, additional technology products - word processing, spreadsheet, database, slide show, Web page - that demonstrate proficiency in each of these areas. Each portfolio is scored according to a rubric of criteria specifying quality and quantity of content.
- The method is exactly as described in parentheses above.
- The teachers self-assess their proficiency with a detailed list of technology skills. So some of the skill areas they provide "samples" as documentation in a hard copy and electronic portfolio.
- Teachers are required to complete several tasks and then email/print/put- on-disk the projects.
- Standard portfolio
- Staff members have to produce two lesson plans utilizing technology in instruction and complete six items from a list of 10 items. Examples of items are locating multiple resources for one teaching topic from Internet or on-line resources, creation of a database, series of documents with specific requirements, etc.
- Teachers are provided a list of acceptable documentation. Principals determine whether these are acceptable to meet the standard. Some schools have a review committee, others don't. Consistency is lacking since some administrators are stricter than others in the evaluation of the portfolio.
- There are three levels of assessment at this point in time, with a 4th under development (web page construction). At each level, the staff member knows what specifics will be needed to pass the rubric. The first two levels are extremely concrete in content. Level 3 demands more

integration within the classroom and sharing among colleagues. Cost effective? I get all the work and evaluate it with the staff member present they make an appointment to see me after school. Anything that needs further work is given back with specific instructions. Staff members may seek help/advice from anyone in the development of their projects for their portfolio. At least it is consistent...only one person is evaluating their material. During the past two years, one after-school afternoon per month was set aside for portfolio work. The demand seems to have lessened as staff members complete the levels. I anticipate designating numerous after school sessions for the web page development. In the past, teachers received recertification points if they attend an after school workshop (1 point for each attended).

- Each standard has different requirements. Generally an individual who is certified validates the skill level of the individual seeking certification. I would guess that a "portfolio" method is preferred.
- We employ the test-out method and the computer-based assessment, we do keep all of the work completed and the tests in a folder.
- Each individual has a notebook with choices of activities to complete that would satisfy each standard. The work is printed and saved on disk. After completion, the individual sits down with a certified technology employee to review work and be signed off.
- Along with the CBT exams, a product was turned in to designate contacts at each school for a pass/fail grade. So during the time frame that the Word component was being tested via CBT, a word processing document meeting predefined stipulations was created as well by each staff member. Stipends were provided for the designated tech contacts at each school that managed the grading and documentation.
- Portfolio is one of the many options teachers have to complete all 8 competencies. It is probably our most popular option.
- We use this method with the Technology Standards for Instructional Personnel. The three technology coordinators in my district agreed on examples or samples that would satisfy those proficiencies. Teachers work on these proficiencies after workshops or on their own time. Staff Development opportunities are given throughout the school year and during the summer.
- The school division portfolio activities are completed and submitted to the principal or his designee for evaluation. Completed portfolio documentation is forwarded to the Instructional Technology Coordinator by the principal for a School Division generated Certificate of Completion. A copy of the certificate is forwarded to Human Resources Department for the personnel record and recertification information.
- I have given this a grade of c as in some of the schools the procedure and expectations are clear and followed and in others it is not. I find the key is the buy-in of the administrator AND the technology skills of the administrator. If the administrator is not technology literate, then the portfolios are almost a sham.

- This is another option that we make available to teachers. It is slightly more cost efficient than the Performance Assessment since the teacher's licensure advisor (or his designee) reviews the portfolio submissions and signs off on them.
- Teachers complete a technology portfolio
- Technology Inservice Days are held on non-instructional days throughout the school calendar
- We have kept all projects on a server in a folder but otherwise it is a portfolio. The teacher is allowed to use the video for the last level of proficiency in their portfolio for teacher evaluation.
- Each teacher is provided with a copy of the portfolio requirements. Each TSIP lists possibilities to demonstrate proficiency of that TSIP. TSIP portfolios are submitted to principals at the end of the year, which are then assessed by the technology personnel.
- Various skills and competencies must be signed off on by a supervisor.
- disk is updated and sent to proper personnel as needed
- Training sessions are given in 2-3 hour blocks on the various skills that need to be mastered. The teachers practice with an instructor on the various skills and then have a product to create on their own to place in the portfolio.
- Teachers complete a portfolio after training on each standard. Then the building administration evaluates the teacher on how well she is implementing technology into the classroom.
- Microsoft Word document and file creation, copy and paste, inserting and downloading clipart, Internet resources including FrontPage HTML Web page design, Excel spreadsheets, and PowerPoint presentations for classroom instruction. This method is hard copied, printed and saved to disk for technology assessment purposes.
- Teachers complete a portfolio of work that indicates their abilities in each of the standards.
- The teachers provide electronic copies of products in the areas of Desktop Publishing, Web Design, Presentations, etc. We then have the products evaluated using specific rubrics. We provide an evaluation, including suggestions on ways to improve their work.
- Teachers are required to demonstrate the ways in which they are using the learned technology skills in their classrooms. They may print a hard copy to put in a provided notebook, and must turn in a disk to the Technology Coordinator. These are due at the end of this school year.
- We use a portfolio assessment for our TSIP completion.

- Teachers who produce a portfolio have found meaningful ways to use the technology and are more apt to remember how to use it later on.
- There is a risk that a teacher will complete an assignment without really understanding what they did. We require students to complete SOL tests to measure proficiency, but allow teachers to use portfolio assessment?
- 2 year program to complete Primary and then secondary competencies.
- All licensed personnel hired prior to the 2002/03 school year were required to submit a portfolio of documentation for TSIP certification. The portfolio assessment was developed by a team of educators within the division and each staff member had up to 3 years to complete all portfolio requirements. Depending on the standard, staff members had to complete between one and four submissions to qualify as "evidence of mastery" for each TSIP Standard.
- The Portfolio must contain evidence of mastery. To quality as "evidence of mastery" submission must consist of items specified under each Standard.
- Teachers and administrators keep samples of lesson plans demonstrating use of technology in classroom and samples of their work and students work in their documentation for evaluation purposes.
- A teacher committee reviews and grades the portfolios.
- The teachers are given multiple options under each area of competency. They select a specified number of options in each and document their use of each.
- We adopted a list of suggested ways in which teachers can demonstrate proficiency in each standard. For instance, to demonstrate that a teacher can communicate with parents using computer technology, he/she can contribute a newsletter, bulk e-mailings, web site, etc. The important factor is to have some archive of the teacher’s computer produced artifact. I am the fourth Coordinator of Instructional Technology this division has had in the past five years. It has been difficult to convince everyone to adopt an outcomes based assessment format, but teachers are slowly accepting it as a preferred method for demonstrating skills.
- Documents are saved to disk and/or printed and given to their administrator.
- For most technology standards, teachers produce computer projects such as databases, spreadsheets (with and without formulas), etc., and these are submitted for assessing proficiency.
- Teachers were asked to document use of technology to produce: a digital image, worksheet, PowerPoint presentation, WebPages, and lesson plans that integrated technology, as well as evidence of student assignments using WP, DB, SS, & the Internet.

- Teachers choose 5 items to submit. Specific criteria must be met.
- The assessments vary from school to school as each schools technology coordinator assesses individual teachers. In theory, the coordinator asks each teacher to submit materials that indicate that the teacher has mastered the individual standard being assessed. The effectiveness of the system is thereby totally in the hands of the individual coordinator. Some do an excellent job; others don't. I have one coordinator report being offered at least 2 bribes to sign off that the teacher had met the technology goal.
- Since the requirement was put in place by the State, teachers have been instructed to offer examples of their technology skills to their evaluator during any evaluation conference. Once an item has been checked off, that item can be removed from the "portfolio", thus minimizing the amount of paper required to be maintained.
- Each instructional staff member completes an independent portfolio containing two word processing documents, which adhere to specifications, a database with at least five fields and five records, a spreadsheet including at least 20 cells, two software review evaluations, and a demonstration of telecommunications proficiency. Staff development workshops are given in areas of need to support individuals needing assistance.
- The portfolio assessment is used to "fast track" those teachers that might not need a full 5 hour workshop on each of the standards for various reasons.
- Teachers submit portfolio products from a choice of projects for each of the teacher standards.
- _ Schools uses the portfolio assessment. I find that this allows the teachers who know how to use the computer the freedom to complete their portfolio and turn it in. The instructional personnel who need assistance with the portfolio process attend workshops and the skills in which they are deficient.
- Technology coordinators in each school review the teacher's portfolio and sign off that they have completed their technology proficiency.
- Teachers maintain a written record of assignments in a binder and are evaluated by school administrator at end of year
- This is an option, not all staff chooses to do a portfolio, electing coursework or workshops instead.
- We use a portfolio of products to demonstrate proficiency in basic tools (WP, SS, DB), web design, and use of scanner/camera.

Appendix T

Descriptive Survey Responses on the Paper Pencil Assessment Method Stated In Context (SIC)

Script # 4. Is the Paper/Pencil Assessment a method your school division uses to assess proficiency on the technology standards? (The individual responds to specific items by the school division on a paper using a pencil.) Briefly describe this method:

- Teachers are given a test made up of DOE-released Technology SOL test items to assess certain basic knowledge. DOE established the validity of the test items. It is interesting that you did not ask about reliability and validity of options 1, 2 and 3. Is this a bias on your part?
- Used on terminology.
- Again, perhaps this is something that should be investigated/instituted. This could be a specifically measured item with analysis of each question and their responses. The development would take time -- cost effective? This is difficult to determine at this time.
- There are several tests on vocabulary, ethics, and legal issues, but these are few. The tests have been designed by instructors who have had training in tests and measurements.
- Individuals take 2 different tests to demonstrate proficiency
- Paper and Pencil methods used for technology assessment are mostly multiple-choice test. The test pertains to proficiency material outlined in the technology training syllabus. Paper and Pencil assessment is beneficial in assuring that teachers understand technical terminology and vocabulary.
- The local community college produced the Assessment.
- Paper & pencil assessment is not being used any more. Any evidence of teacher’s knowledge, skills and abilities in the past disappeared with past tech. coordinators.
- A multiple choice technology vocabulary test is given when the portfolio is submitted.
- In our school system, there are two paper/pencil assessments, one on vocabulary, and one on privacy/internet use.
- Teachers were asked to take written test on: technology terms and basic troubleshooting.
- As described in part 1, our method is a combination of online and paper/pencil. The document is filled in online but is then printed and signed by both teacher and principal.
- We have conducted surveys to determine how competent teacher feel they are in certain areas. Inservice is then conducted in areas deemed necessary.

- We only use a paper and pencil test to assess teacher knowledge of basic computer terms and concepts.
- We only use paper/pencil for the vocabulary portion of the technology proficiency requirements.
- We use a multiple-choice format to test for knowledge of terminology. We have not tested it for either validity or reliability.
- We use a self-assessment instrument to place staff initially in a professional development tier for technology training.
- Not used.

Appendix U

Descriptive Survey Responses on the Professional Development Assessment Methods Workshops, College Courses and Mentoring Stated In Context (SIC)

3-4 hour workshops (1-5 sessions) Community College 45 hour classes. Technology Coaches at each school assist teachers with skills & portfolio performance (receive $1,000/yr supplement)

- Workshops: A variety of 4 hour workshops that address standards A-D and an Open Lab to help teachers create products for E-H . Skills Checklists completed during workshops. Projects created in workshops applied to portfolio for E-H. College Courses: Syllabi submitted to Department of Technology for review. Credit for one or more or all standards may be given. We offer the___ Certificate classes here, as well. Those who complete all six classes and earn certificate from ___ meet all standards. No portfolio required. Mentoring is provided by school based technology/instructional staff. Some are dedicated to instructional support for 1/2 day. Some are given a stipend for work they do beyond the school day.

- Workshops and courses that meet the specified criteria may be substituted for related modules in the TIE curriculum. Workshops vary in length from 2.5 to 5 hours. College classes are one semester courses and typically meet once a week for 3 hours. We employ certified staff as mentors to provide telephone and online support to participants enrolled in our self-paced, self-instructional Virtual TIE program. We also recognize the Intel Teach to the Future program as an alternative route to meeting the TSIP and offer one cohort per semester in the district.

- Workshop times vary. Some are one-half day, others full day, and others college courses. Mentors are assigned to all new teachers for a 3 year period. These mentors work with the technology standards. We also have open computer labs one night per month in each school. Lab specialists are on hand to assist with mastery of technology standards.

- Workshops are usually about 8 hours, though not necessarily over one day. College courses can be once per week, or Friday evening/all day Saturday for four designed weekends, or teacher selected times if the instructor is flexible. Mentoring is done by more proficient teachers who serve as technology contacts. This is an "extra non-paid" duty for them. Lead teachers have also mentored and they have been paid a small stipend from a grant.

- Workshops are one day or 1/2 days - could be group or individual basis - depending on need College courses are usually 8 hour days for one week Mentoring usually depends on new staff - their ability and needs

- School technology team workshops vary from 1 hour to 8 hours depending on subject being covered. Subjects such as learning to use a digital camera may take an hour where as, learning to effectively use a data box would take much longer--8 hours or in some cases several days depending on skill level.

- Although we utilize workshops & college courses for professional development, we still require our staff to complete our own assessment of their proficiency. Workshops and college courses are a less-reliable means of documenting proficiency on the standards.

- Workshops are 9 or 12 hour sessions taught after school in 1 1/2 increments. University course is a four, Friday-Saturday offering.

- Workshops are held after school generally at the school site by one of or tech people. They average 30 min. to 1hr. in length and may take more than one day depending on the topic and experience of the individuals taking the workshop. We are thinking about a "train the trainer" model to provide support with in the building and with in the classroom. Integration of technology with instruction is our focus.

- Workshops last 1 day, courses usually last a semester.

- College course is 3 credit hour course on intro to technology or use of technology in instruction. Staff need to attend workshops, each of which is 6-8 hours in length and meets 3-4 times.

- The college course met 3 hours each week for five weeks. Participants completed a variety of tasks which focused on each of the technology standards. The culminating activity was the development of an SOL based lesson plan incorproating technology. This lesson plan was posted to a division website of lesson plans and the lesson plan had to be observed by an administrator.

- College course schedules vary but are 15 clock hours for 1 graduate credit. If the series of 6 are successfully completed a certificate is given which automatically shows completion of the TSIPs.

- Time varies depending on the content.

- Workshop is for six hours, per standard. We meet for 3 hours, two days

- Currently, we don't use them to assess proficiency, but do give credit that they participated. Each faculty member needs a "class" in Technology per year. We provide evening classes through _ Community College -- based on various topics (Basic Internet, Internet Research, MS Publisher, MS Word, etc.) I teach them for _ CC and we have them on campus. They are from 1-credit seminars (15 hours) to 3-credit college courses. None of these are used to "assess proficiency standards."

- Per skill, workshops are 2-3 hours. Certified in-school teachers will verify the skill for the teacher. I have no idea how effective this is, but then, the entire theory of the technology certification program is terrible. When you coerce requirements, people generally take the avenue of least resistance.

- Workshops are done in conjunction with the Performance-based Assessment described above. In instructor teaches basic skills and then assesses teacher performance. The sessions are taught in 3-hour increments after school. A workshop on Using the Internet might last 3 sessions while a workshop on PowerPoint might be 4 sessions. (Previously, this division has had these workshops during the summer, where workshops were lasted up to 2 weeks, 6 hours per day, teaching all of the 8 requirements. College courses have been offered for teachers. Classes have ranged from 1 credit hour to 3 credit hours, usually one night per week. The 1-credit courses lasted 5 weeks while the 3-credit courses lasted the semester.

- After school workshops on integrating technology into instruction and across the curriculum are provided by onsite full time technology trainers. These trainers also work with teachers in their classroom during the school day on a "sign up" basis. College courses on using and integrating technology have been made available free of charge to instructional staff as well. Lastly, a new online mentoring system was deployed this year and appears to be successful, although our complete evaluation wont be ready until the end of this year. Its difficult to put a single grade on each of these endeavors, since the relative success of each varies with each workshop and course. The cost efficiency is also relative to the varied outcome documented, but is worthwhile overall.
- Courses from local universities are accepted as verification as some or all of the TSIP depending on the content of the course. In addition, our staff development office offers a wide variety of courses, varying from 1-3 credit hours (15-45 in-class hours) that verify all or part of the competencies.
- The workshops are always short: three hours at most. Usually only one topic is covered as teachers have complained in the past of being "inundated" The person providing the mentoring is either the Technology Coordinator or a grade level team leader.
- All teachers participate in two 6 hour days of technology at the school level but provided by the division.
- Workshops are held either after school for approx 1 hour or during staff days when there are no students at school. While cost effective - these aren't required and most often the people who really need the help don't attend. There is systemic means of tracking attendance or proficiency as a result of workshop attendance.
- We have a full-time technology training specialist on staff who offers classes at our Technology Training Center on various technology strands (MS Word, Excel, Access, PowerPoint, etc.). Classes are offered during the day and after school hours. Some substitute coverage is provided for school day classes. Classes are also taught in various formats (day long, 2 half-day classes, 3 two-hour sessions, etc.)In addition, some integration and special topic classes (GradeQuick, GroupWise, etc.)are taught by technology resource teachers at school sites.
- Workshops and courses are various and may or may not be for all teachers. Mentoring is provided to teachers new to our schools system and includes many areas including technology.
- We offer college courses through the local community college. Courses last for 5 weeks and meet for 3 hours each week (usually 1 day or 2 days per week).
- Workshops run from one hour to 8 hours. We have found that a 2 hour session several times is

better than one 8 hour session. The mentoring is done by one person at each school known has the Tech Coach.

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We offer technology courses in a 10 hour beginner format with a competency test at the end of each workshop. We offer these workshops at the division and school level throughout the year.

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Workshops will vary depending upon the skill under development. I estimate the teachers could work through workshops related to the tech. competencies in 10 hours.

• With certain grants, our division offers college credit classes to staff members. In addition, on-going workshops are offered during the school year and summer. Probably one of the most current methods we are now using is our mentoring program. All new teachers have a mentor at their school who addresses technology integration with the teacher and provides necessary activities and help.

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The workshops are given throughout the year by the lead technology teacher in each school. The materials are written and provided by the instructional technology specialist for the school system. Each workshop is held after school for 2-3 hours.

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Workshops--15 hours over a three days •College Courses--Provided during the summer 2 times a week for four weeks. •Mentoring--Technology Specialists at each school provided mentoring to all teachers.

•

We have used 3 credit classes and 1 credit classes. The problem we found with the college classes was poor quality of the classes at the institution. We stopped accepting credits from our local community college.

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The Workshops are held 2 times a week (4/hours) per day, which is 2-Days a week.

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Partnered with __Community College to assess and then remediate technology deficiencies

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Workshops are held in two hour sessions. College classes are for 3 credit hours

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Workshops are designed for specific training. The workshops could be from 2 hrs to several days. We offer a 3 Hr. Graduate course that is for advanced use of technology, and has an instructional focus. Mentoring is used for teachers with computer phobia or slow learners of technology.

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We have after-school sessions at each school, one day per week and then offer a 3-4 day summer workshop to interested teachers. Grant monies pay teachers/trainers to attend the summer sessions and trainers for the after-school sessions. These have been very successful in helping our teachers reach proficiency.

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Workshops vary in length and are delivered at each school. We do some summer workshops that could be full day. We have offered college classes. Our Instructional Technology Specialists in each school do serve as mentors.

- Workshops were conducted during our pre-school weeks the past couple of years, as well as during professional development days. The length varied from 1 hr. to 3 hrs. depending on the sessions. Many teachers took professional development courses at local colleges and we also provide mentoring for teachers from lead technology literate teachers in the buildings.
- We used to offer a summer course session, but we no longer do that. The summer session was a week. We also had a cohort program with _University for teachers to complete a certificate program. Now, we mostly use our Technology Lead Teachers and our Instructional Technology Training Specialists to act as mentors.
- Workshops are 5 days (25 hours). College courses that meet the state requirements are acceptable.
- Workshops vary from 1 to 6 hours, 3credit college courses, lead teachers mentor
- Workshops vary from 1 to 3 hours depending on content covered and capabilities of the participants. TLC grant monies were used to develop a mentoring system that focused on using technology in the content area, which also addressed the Teacher Technology Competencies.
- Technology-related workshops are held on pre-service workdays and all inservice days during the school year. Workshops last anywhere from 206 hours and cover a variety of technology issues._CC provided hands-on remediation for any staff member who needed help with completion of TSIP standards. Additionally, __ routinely sends staff members to technology training outside the division. Anyone attending this type of workshop is expected to share their experiences at faculty meetings or inservice sessions. Teachers in this division routinely mentor each other and share information and ideas about technology.
- Workshops are used on occasion when a new product comes in such as SASI. It is usually a half day session and usually takes place in the summer.
- full 8 hour workshops, 1-3 credit courses offered, professional development offered by __Community College
- Workshops vary in length and time. Some were one hour to six hours. College classes from 1credit to 3 credits.
- One-semester hour courses were designed for each of the major areas covered in the technology standards (example: Powerpoint, internet, word, excel, project driven instruction, etc.) Therefore, 15 hours of instruction was required for each topic.
- We have ~ 20 in house trainers that we have trained thru the IT department staff and some college instructors. In general, I have found the about 50% of our college instructions (workshops) are good. The other 50% are out of touch, poorly informed and focus on areas that are not important such as the gee whiz type material. The poor instructors do more harm that we have to work hard to undo. Once a teacher has a bad experience it is hard to bring their attitude

around. When we find the great ones we try to use the over and over. Generally, inside people(hand picked)that are carefully trained are the very best trainers.

- The college course in 3 credit hours. Teachers must turn in the portfolio to our school also. Workshops very and are usually 1-2 hours and cover a specific topic or are used to assist individual teachers with their concerns

- Workshops meet for 6 hours. __ has developed 8 online integration modules for ___. Mentors are assigned to each participant.

- Workshops: Weekly, 2 hours (Technology specialists and *Community College) College courses: semester, 3 hours credit (*_ Community College) Mentoring: Arranged for individuals and duration until they completed requirements for the proficiency; provided by other employees

- Workshop- 3-5 three hour sessions College courses- 1 three hour session per week for a semester

- Workshops: 3 - 6 hour sessions on a specific task (i.e. using databases, or using PowerPoint, digital cameras, etc.) 15 hour session on using AppleWorks Word Processing or MS Word, etc. Course: 16 week 3-graduate hour course @ __ Community College (IST-195 Computer Applications for Teachers) designed to cover and evaluate all 8 of the TSIP.

- Our technology people and others in the system who are obviously proficient in a given area provide 1 to 1 and 1/2 hour workshops generally after school but occasionally on professional development days. The last series of workshops lasted for about 12 weeks.

- The workshops are part of an annual summer technology academy, a series of 30+ three hour workshops offered to employees. The college courses are annual courses offered at two levels (Beg/Advanced) through local universities. These courses meet for 45 contact hours over the traditional college semester. The mentoring is provided by building-level technology contacts who are paid a small stipend for their work.

- Workshops consist of 3 1.5 hour sessions per topic.

113 We offered and/or supported a large number of opportunities for staff development using both Technology Challenge Grant funds and local funds. Time patterns ranged from 2 hours in some workshops to 10-12 hours in others. Courses ranged from 1-3 semester hours.

- Workshop on Windows-one 3 hour session College Courses on "Internet in the Classroom"(3 credits-1 semester) and "Microsoft Office"(3 credits-1 semester)

- We have provided numerous after school workshops (defined as lasting less than 5 hours) and series of college credit courses over the last five years. We have partnered with __University to provide the college credit courses, some one credit hour, others three credit hours. We also have paired up teachers in schools for those needing more one on one support.

- Workshops consist of various training sessions which vary in topic and length. Some independent instruction (videos, CD-ROMs) gave also been used. Mentoring by peers and/or "Technology Lead Teachers" to help with specific tasks and/or problem areas.

- For staff members who have successfully completed an approved 3-credit collegiate course in basic instructional technology, the portfolio requirement is waived.

- Workshops: Taught in 5 hour blocks for each of the 8 technology standards. College Courses: Used to teach a cadre of Technology Lead Teachers (TLTs) to conduct workshops in each school in the division.
College classes met once a week for 16 weeks. Instruction was poor and no integration strategies were taught. Workshops are offered after school for 2 hours but poorly attended.

- A variety of methods, courses, and time-frames are used.

- A variety of methods were used: Series of workshops in each area College course 3 graduate credits/semester

- The division partnered with a community college to offer a three-credit hour course on campus. This course was often taken by persons who had little or no computer literacy.

- We have been able to offer a college course through __ Community College which covers the standards and allows teachers to complete most of the required portfolio pieces as class assignments. It only meets once a week for the full semester, but meets the clock hour requirements for a 3hr college course. We have identified "technology savvy" teachers at each school who are paid a stipend to stay after school one day a week to act as technology mentors. They can be used by teachers to prepare for performance assessments and to assist them in preparing the portfolio products.

- Our teachers may use professional development to help them get the skills to pass their technology proficiency requirements, but the classes themselves do no count towards their proficiency.

- Workshops are usually 2-4 hours; Some training is one-hour per week for 8-12 weeks; we have used some on-line training opportunities for specific skills; On-site college courses (15 contact hours per college credit).

- Workshops vary, but are generally 12 hours over 2 weeks. We offer 1 and 3 credit graduate courses, meeting times vary and include an online component in many cases.

- We provide a series of regular inservice courses (2 hrs/day, once a week for 6 to eight weeks). We use more intensive summer boot camps (2-3 days, 6-8 hours per day). Taught by TRTs or teacher experts. Used TLC grants to bring in outside specialists. Mentoring is provided primarily by Tech Resource Teachers. Effective but not enough TRTs to go around. These courses help develop proficiency but are not, in themselves, an assessment tool.

- PDA technology sessions are 6 hours long and each staff member must give 12 hours in the summer. During the school year, small group sessions are conducted on site for 1.5 hours per week for 12 weeks using site-based hardware and software.
- We provide 1- 1 1/2 hour after school classes on various topics, and teachers can take several to meet each standard. Teachers offer most of these classes; in this way, we utilize in-house talent and reinforce leadership roles for those using technology in their classrooms. We also accept college course, provided they meet our criteria as given by the state. Mentoring is done by the county technology coordinator, and its usage/implementation varies.
- All workshops are teacher-led under the guidance of the technology lead teacher in the building. The college course is one day PER week and extends according to the credit given. The central office coordinator provides mentoring supervision.

Appendix V
Respondents Comment How to Improve Method if Graded a C or Below
(Stated In Context)

#1.Computer Based Assessment	Our method insure basic competency but does not insure continued growth and expansion on technology skills. It is a one-time demonstration of the competencies.
	Computer Based Assessment - I would like to tie this in with a workshop or set it up as a more complete online course.
	Rate it a B-. The main reason is the lack of organization. To little people wearing to many hats in our small single A school
	Comptency tests
	the process is good; however, I'm not sure it really tests if a person understands & can properly use technology.
#2. Performance Assessment	Performance/portfolio. It will only be better when teachers all have hardware that will allow us to implement the draft version of our new competency assessment. That will mean additional funding. Teachers feel no need to spend time learning how to do something they cannot do in their classrooms with their current old equipment.
	Performance assessment allows someone to prepare for the test but does not require application to a discipline. It would be more meaningful if done so.
	Our system is based on the assumption that all teachers are professionals and depends on them attending to their responsibilities. This system as the strength of treating teachers in a professional manner. Of course this is a flawed assumption, and some individuals may cheat or ignore their duties. We believe that as in the classroom we should not treat the whole at the base level of the few.
	Performance Assessment - We needed this option for teachers who are not taking a the college course to meet the objectives. The main weakness with this option is that we only have one evaluator serving 5 schools, and the evaluations often have to be done after the regular teaching day. Having funds for more technology specialists and release time would make this option more effective.

Appendix V Continued
Respondents Comment How to Improve Method if Graded a C or Below
(Stated In Context)

#3.Portfolio Assessment	I think the portfolio became more of a checklist rahter than showing that teachers had the skills to integrate the technology. We could have also done a better job of teaching administrators to evaluate the portfolio. They needed more guidance on whether this truly showed proficiency rather than being guided to perform a task which could then be included in the portfolio
	If you want people to use a certain technique in instruction, then there needs to be (a) incentives and (b) demonstrated pedagogical benefits. We give lip service to instructional technology, and beyond the gee-whiz factor, it is hard to convince teachers that one pedagogy is better than another in terms of improving student outcomes.
	Better training for the administrators and possible having the technology portfolio looked at by an independent skilled group
	Written Portfolio is what we currently use. We are looking to overhaul our assessment process. An electronic portfolio is of greatest interest at this point.
#4.Paper-Pencil Assessment	#3, #4 Portfolio and Paper Pencil -Both could be better with more uniformity from coordinator to coordinator and school to school. In actuality, using method 1 or 2 would likely be better but we are focusing our time on working with those teachers who are most interested in technology and getting them more proficient in using technology to improve their instruction.

Appendix V Continued
Respondents Comment How to Improve Method if Graded a C or Below
(Stated In Context)

#5 a. Professional Dev. Workshops	I would like to see initial technology training at a central location with a greater focus on integration of tech. with instruction. A site representative who has been trained and checked for Competency would then add support at the school level. Documentation would then be consistant with expectations, feedback for "focus areas" could be identified and supported. Communication of expectations and monitoring of success would hopefully be enhanced. Cost would be location for training (school lab/ divsion lab) release of teachers for training, site person or Instructional Technology person with an understanding of curriculum and instructional design.
	Workshops can be effective when part of a larger picture of staff development in technology. This would require that there be mandatory attendance by those who need it and there is a followup with those individuals who are not proficient.
	With respect to Professional development, more teachers should attend the workshops, not just those that are technically inclined.
	Workshop method tends to be "boring" and does not allow practice of what, by its very nature, is a "hands on" skill set.
#5 b. Professional Dev. College Courses	College Course - Not effective, teachers are tired of the traditional course approach
	The school division did not have a planned process until I came to the district. They pretty much signed off on anything the teachers did.
	College courses - better taught by K12 peers. More creditability that way.

Appendix V Continued
Respondents Comment How to Improve Method if Graded a C or Below
(Stated In Context)

#5 c. Professional Dev. Mentoring	If we had more time and resources, a portfolio method would have been much better due to the teachers being able to be hands on and active in the learning process.
	Mentoring - time for employee and mentor to spend together difficult to schedule. If substitutes were hired, cost would be expensive.
#6. Signed Demonstrated Proficiency Statement	The method is OK, but not highly utilized. Used by a few principals for select staff. Problems here are with having principals KNOW what it is they are looking for! That has been the focus of administrative staff development this year.
	All of our processes could be and will be updated to match the NEW standards of integration - all new staff coming from the colleges should bring a certificate or proof of being able to perform-
	Signed Demonstrated Proficiency Statement: I put a C here because this is still in progress. I have no real feedback on the results.