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Assessing Teacher Candidates' Perceptions and Attributions of their Technology Competencies

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This study presents a longitudinal comparison of teacher candidates' perceptions of their technology competencies as they enter and exit a teacher preparation program using a survey instrument. The survey instrument utilized questions about teacher candidates' perceived abilities to apply the International Society for Technology in Education's National Educational Technology Standards for Teachers (ISTE, 2000). The instrument and study findings are included. Findings indicate that upon entrance to a teacher preparation program, prospective teachers are computer literate, but even toward the end of their program, need further instruction and experience in pedagogical applications of technology. These findings serve as baseline data that the program will continue to collect over time to gauge and improve teacher candidates' confidence and performance with technology.

Keywords: Technology, teacher education, assessment, standards, teacher preparation

INTRODUCTION

Since the introduction of computers into classrooms, and particularly with the creation of the International Society for Technology in Education's (ISTE, 2000) National Educational Technology Standards for Teachers (NETS*T), faculty within schools, colleges, and departments of education (SCDE's) have grappled with how best to prepare future teachers to harness the power of technology in ways that enhance their effectiveness and enrich P-12 students' learning experiences. The ISTE has convincingly argued that technology must become an integral part of the teaching and learning process in every setting supporting the preparation of teachers (ISTE, 2000). With the support of Preparing Tomorrow's Teachers to use Technology (PT3) funds beginning in 2000, the Secondary Education Program faculty at The George Washington University (GWU) focused on integrating technology use in courses and student assignments. Common uses included online courseware, presentation software, web-based inquiry projects, and digital imaging. Although the intent was to build a cohesive set of experiences spanning

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coursework and field experiences, the reality was inconsistent and sometimes led to redundant instruction or assignments. A contributing factor was that the framework for constructing students' experiences grew out of faculty interests and expertise rather than students' needs.

As a graduate teacher preparation program committed to facilitating students' construction of knowledge, beginning in 2004 program faculty have endeavored to assess the depth and breadth of teacher candidates' prior technology-related knowledge and experience upon entrance to and exit from the program. Mindful of several reports that SCDE's were not adequately preparing teacher candidates to integrate technology effectively in their future classrooms (see e.g., American Council on Education, 1999; CEO Forum of Educational Technology, 1999; ISTE, 1999a; National Center for Education Statistics, 2001; National Council for Accreditation of Teacher Education, 1997; President's Committee of Advisors on Science and Technology, 1997), program faculty have striven to gauge the needs of teacher candidates accurately so that learning activities in which prospective teachers are required to engage are meaningful rather than perfunctory, and program resources—especially faculty expertise and time—are not squandered.

Faculty applied a systematic pretest-posttest design (Campbell & Stanley, 1963) to collect data to determine if teacher candidates' perceptions of their technology knowledge and competence changed between their entrance to the secondary education program and completion of the licensure sequence (24 credit hours of the 36 credit hour masters program). On the front end, this approach helps to dispel any preconceived notions faculty members might have about teacher candidates' knowledge, experience, and attitudes about technology. Also, it serves to inform the faculty as they make decisions about integrating technology in curriculum, instruction, fieldwork and in allocating resources. The post data reveal if those decisions yield the desired outcomes, namely increased technology knowledge and competency and positive attitudes about using technology in secondary classrooms used by other teacher preparation programs. A particular strength of this model is that it affords thoughtful examination of the technology preparation of teacher candidates through orderly and targeted data collection aligned with national technology standards and accreditation requirements.

SURVEY INSTRUMENT

PURPOSE AND DEVELOPMENT

The survey (see Appendix) was designed during the 2002 – 2003 academic year by a three-member team at GWU and reviewed by ten other experts across the United States specializing in educational technology. The analyses and recommendations provided by the technology experts were incorporated to improve the content validity of the survey. The purposes of the survey were to: 1) examine teacher candidates' background, experience, and perceptions about using technology, 2) gather baseline data about their background, experience, perceptions, and use of technology, and 3) pilot an assessment instrument that yields data useful to program improvement. The survey was developed based on an examination of the literature of technology survey instruments and research on the relationship between self-efficacy and attitudes about technology.

A table of specifications (Gronlund, 1993) was created to ensure that each item on the survey addressed at least one NETS*T. Some items addressed more than one standard, but only one "goal" within each standard. Consisting of three major parts—demographics, computer literacy and training, and pedagogical uses of technology—the survey was then subdivided into the following sub-categories:

1. Part A: Demographics (5 questions)
2. Part B: Computer Literacy & Training
   a. Computer Literacy (15 questions)
   b. Current & Emerging Technology Development (4 questions)
3. Part C: Pedagogical Uses of Technology
   a. Planning, Instructional Design, and Management (9 questions)
   b. Assessment and Evaluation (5 questions)
   c. Productivity and Professional Practice (8 questions)

Bloom’s Taxonomy (Bloom, 1956) was also utilized to analyze and develop the test items. Bloom’s Taxonomy is a classification system of cognition that identifies a continuum of six different levels. The levels, from lowest to highest, are: knowledge, understanding, application, analysis, synthesis, and evaluation.

The majority of survey items were constructed to ascertain how teacher candidates learned to do a particular activity such as “Design lessons that use technology to meet the individual needs of students,” and the degree to which they were able to complete it. They could choose any of the following with regard to such an item: “I cannot do this,” “Primarily self-taught,” or “Formal Instruction.” If respondents choose the first option, they move to the next item. However, if they choose either of the latter two, they are to identify the level at which they can perform the item: “I can do this with some assistance,” “I can do this independently,” and “I can teach this to others.” Scoring of these items was as follows:

- “I cannot do this” = 0
- “Primarily self-taught” and “I can do this with some assistance” = 1
- “Primarily self-taught” and “I can do this independently” = 2
- “Primarily self-taught” and “I can teach this to others” = 3
- “Formal Instruction” and “I can do this with some assistance” = 4
- “Formal Instruction” and “I can do this independently” = 5
- “Formal Instruction” and “I can teach this to others” = 6

The rationale for this format was that from the exit surveys, faculty members want to know 1) how teacher candidates learned to do a particular activity (e.g., formal instruction in the program) or if they were self-taught; and 2) the degree to which the candidates perceive they can perform the particular activity with the ideal notion being that teacher candidates will feel confident enough to be able to teach others how to perform such activities.

LITERATURE REVIEW

The survey instrument was developed based on a review of the literature that examined existing technology survey instruments and research on the relationship between self-efficacy and attitudes about technology. After a thorough review of the existing literature and published instruments (Atkins & Vasu, 1998; Becker, 1994; Brinkeroff, Ku, Glazewski, & Brush, 2001; Christensen, 1999; Dawson, 1997; Delcourt & Kinzie, 1993; Knezek, Christensen, Miyashita, & Ropp, 2001; Lumpe & Chambers, 2001; Milman & Molebash, 2000; Moersch, 1999; Molebash & Milman, 2001; South Central Regional Technology in Education Consortium, 1999), the team chose to develop its own instrument based on the ISTE NETS*T.

Self-efficacy, an individual's perceptions about his or her ability to perform a specific function (Bandura, 1993, 1997), is a good predictor of behavior. Those with low self-efficacy tend to shy away from situations where they believe they have little control or ability to handle a task. Consequently, those with low self-efficacy toward technological innovation are likely to feel high levels of anxiety, and as a result, resist learning to use computers. Those same feelings of inadequacy about technology regulate the degree of commitment and perseverance an individual is willing to invest in the learning situation (Albion, 1999; Olivier & Shapiro, 1993).

In the past, studies have found that typical teacher candidates are somewhat anxious about computers, feel unprepared to use them, but want to learn about them (Blythe & Nuttall, 1992; Lichtman, 1979; Mueller, Husband, Christou, & Sun, 1991). Willis and Mehlinger (1996) also noted studies that found completion of a course on educational computing improves attitudes toward technology in the classroom of inservice teachers (Baird, Ellis, & Kuerbis, 1989; Berger & Carlson, 1988; Madsen & Sebastiani, 1987; Nanjappa & Lowther, 2004; Richardson-Kemp & Yan, 2003; Topper, 2004; Yildirim, 2000) and preservice teachers (Albion, 2001; Anderson, 1991; Gunter, Gunter, & Wiens, 1998; Huppert & Lazarowitz, 1991; Milbrath & Kinzie, 2000; Savenye, Davidson, & Orr, 1992; Yildirim, 2000).

Although current studies expand upon previous findings on teachers' self-efficacy and technology (Stuve & Cassady, 2005; Wang, Ertmer, & Newby, 2004; Watson, 2006), other studies paint a more complex picture about teachers' perceptions of technology. For example, several studies examine the relationship between technology and teachers' beliefs (Albion & Ertmer, 2002; Ertmer, 2005; Judson, 2006; Levin & Wadmany, 2006; Lumpe & Chambers, 2001; Swain, 2006), as well as the assessment and influence of dispositions vis-á-vis technology (Jung, Rhodes, & Vogt, 2006; Vannatta & Fordham, 2004).

Although the self-efficacy and attitudes of preservice and inservice teachers are studied far more than any other aspect of technology in teacher education, according to Willis and Mehlinger (1996), few would argue against the need for understanding one's target population. This is especially true when one considers the varying levels of technology experience and competence one might encounter in any classroom—no matter the educational level! However, this is even truer when one considers the student populations in this study, whose ages range from 22 to over 54 years of age. Understanding teacher candidates' perceptions about their ability to use technology, especially for pedagogical purposes, is of utmost importance to the teacher educators in this study.

*CHALLENGES IN USING THE NETS*T AS A FRAMEWORK*

Designing a survey using the NETS*T as a framework was challenging in several ways. First of all, the standards are quite broad, complex, and open for interpretation. It was difficult to develop test items that measured the items accurately considering each standard has several related "goals" and also is not "stand-alone" in that there is cross-over among standards. Bloom's Taxonomy was used to analyze standards to address this challenge. Table 1 illustrates how the standards fall at the higher levels of Bloom's Taxonomy that are more difficult to assess than lower levels, particularly in a survey format.

Secondly, many of the standards seem to require prior experience in the classroom (where teacher candidates could demonstrate application of the standard in a classroom setting with real students). Clearly, at the onset of the Secondary program, few teacher candidates would have had any prior teaching experience. A third challenge was evaluating technology competence with a measure that was not performance-based. Yet, even with these concerns, the survey option was chosen for this study because it was the least invasive and most efficient way to collect the data desired to help determine any gaps in teacher candidates' perceptions of what they know and can do with technology. Additionally, it clearly defines areas in which faculty need to focus.

*Table 1. NETS*T vis-á-vis Bloom's Taxonomy*

Level	Standards
Evaluation	5B1
Synthesis	2A, 2D, 2E, 3A, 3D, 6A1, 6A2, 6D, 6E
Analysis	5B2
Application	1A, 1B, 2B, 3B, 4A, 4B, 4C, 5A, 5C, 5D, 6B, 6C2
Comprehension	--
Knowledge	2C, 6C1

SURVEY PILOT, ADMINISTRATION, AND RELIABILITY

The pilot survey was initially administered in the fall of 2004 to 12 students (these data are incorporated as part of the 63 analyzed in the pre-survey results), and since then, at the end of each fall and spring semester, to any students entering or completing the student teaching internship. The time period between the pre- and post-test varied, ranging from 12 to 24 months since students in the DELTA program progress at their own pace (e.g., some students take only one or two courses per semester). No changes have been made to the survey although guidance about how to complete the survey has been fine-tuned with each administration (see *Issues Administering the Instrument* below). Through analyses of the initial pilot survey results and data collected from subsequent cohorts, the instrument has been found to be reliable. Cronbach's alpha reliability coefficients were calculated to assess the internal consistency of the entire instrument and each of the five subscales. The instrument was proven reliable with a range of .737 to .952 for pre-survey data and a range of .753 to .935 for post-survey data. Reliability coefficients of .70 or greater are considered acceptable (Fraenkel & Wallen, 2006). Table 2 represents the reliability coefficients for the survey instrument and each of the five subscales.

To date, the pre-survey has been administered to teacher candidates as they entered the "Delta" program option between 2004 and 2006. In the Secondary Education Program, six options are available to teacher candidates that allow them to obtain their teaching license and degree through a variety of field experiences. Additionally, each option differs in the duration of the program and the financial assistance provided students. The Delta option allows teacher candidates to self-pace, taking as few as one or as many as four courses each semester. Many of these students continue to work during the day and take classes at night as they transition to the teaching profession. Of the 63 respondents on the pre-survey, 68.3% were female, and 31.7% were male. Their ages ranged from 22-54 years of age (with a mean of 33.7 years). Also, 60.3% reported having only a bachelor's degree prior to enrolling in the program, whereas 30.2% reported having previously earned a master's degree, 6.3% a professional degree, and 3.2% a post-bachelor's certificate. Post-surveys (12 to date) have been administered at the conclusion of the teacher candidates' student teaching internships.

Table 2. Instrument Reliability Coefficients

	Pre-Survey	Post-Survey
Survey Instrument (41 items)	.952	.908
Computer Literacy	.868	.753
Current & Emerging Technology Development	.737	.840
Planning, Instructional Design, and Management	.945	.935
Assessment & Evaluation	.879	.910
Productivity & Professional Practice	.919	.890

* Reliability coefficients of .70 or greater are considered acceptable (Fraenkel & Wallen, 2006).

ISSUES ADMINISTERING THE INSTRUMENT

Conducting any type of longitudinal research, particularly with a group that completes a program at various stages (some of the students in the DELTA program take up to three years to complete the program), takes time. As such, it may be several years before the faculty members are able to gauge the results of the study in question. Even so, there were several other issues associated with the administration of the survey that needed fine-tuning.

Initially, a portion of the assessments for each cohort were turned in with incomplete items or even incomplete sections due to some confusion about how to complete the assessment or what was being asked. Information gained from piloting the assessment instrument led to instituting a thorough introduction of the assessment. First, teacher candidates are informed of the purpose of the instrument. This is followed with an overview of the content and organizational structure of the assessment. The variety of response choices can be confusing, so it is necessary to model how one would complete the assessment to accurately identify competencies. This is especially helpful in Part C: Pedagogical Uses of Technology. Consistently in each assessment cohort, when teacher candidates with more advanced skills reach this section, they bristle at the restrictions imposed by the language used to identify whether they can do an activity.

To recap, the first three items in this section read as follows: 1) Design lessons that use technology to meet the individual needs of students; 2) Design lessons that are developmentally appropriate for students; and 3) Design lessons that utilize technology to develop students' higher order thinking skills. Their initial choices are "I cannot do this", "Primarily self-taught", or "Formal Instruction". Typically, a candidate with advanced technology skills will say something like, "I've never done this before, but I'm sure I could. Why don't you have a column for that?" Informal inquiries indicate their initial interpretation of the items is that they would use word processing to create a word document, the lesson plan. In fact, the activities are much more complex requiring a combination of technology competencies and pedagogical knowledge to meet students individual and development needs and to develop more complex thinking. Explaining this in advance facilitates teacher candidates' ease and accuracy in completing these items. Finally, a reminder to scan the assessment to make sure that all items have been accounted for goes a long way in insuring that data sets are complete.

DATA ANALYSES AND PROCEDURES

Using SPSS, descriptive statistics analyses (mean, median, standard deviation, and frequency distributions) were conducted to determine demographics and pre- and post-survey participant perceptions of each of the five subscales: (1) Computer Literacy, (2) Current & Emerging Technology Development, (3) Planning, Instructional Design, and Management, (4) Assessment and Evaluation, and (5) Productivity and Professional Practice. Given that there was only one group of participants, survey responses were analyzed using a one-tailed paired t-test to assess whether or not there was a change in the different subscales between the onset of the program to internship completion. Pre-survey and post-survey composite scores were calculated for each of the five subscales. In addition, Cohen's (1988) *d* effect sizes were calculated for each of the paired t-tests to estimate the magnitude of the program effect. Pearson product-moment correlations were conducted to measure whether a relationship (pre- and post-) existed between computer literacy and pedagogical uses of technology and Cronbach's alpha reliability coefficients were calculated to assess the internal consistency of the entire instrument and each of the five subscales. A significance value of .05 was used for this study.

FINDINGS

COMPUTER LITERACY

Pre-Survey (N=63): Generally, the study participants identified themselves as computer literate on the pre-survey. Sample indicators of computer literacy on the survey included student participants' abilities to correct a frozen computer; copy and paste; sort data using a database program; create graphs; use a scanner; create multimedia presentations; use FTP; conduct web searches; and create websites using HTML code or authoring software. On six of the 15 items, the results indicated that a considerable number of participants reported they were incapable of performing the given function upon entering the program: (1) sort data using a database program – 20.6%, (2) edit images using graphic editing software – 30.2%, (3) scan pictures or text using a scanner – 25.4%, (4) create multimedia presentations – 20.6%, (5) use FTP to transfer files – 61.9%, and (6) create web sites using HTML code – 57.1%.

Post-Survey (N=12): On the post-survey, 10 (item #1, 2, 4, 5, 6, 8, 9, 11, 12, 14) of the 15 survey items in this category suggested that all students could perform the required task at some proficiency level. A percentage of participants claim to still be having difficulty sorting data from a database, scanning pictures or text, using FTP, and creating web sites using HTML code. No statistically significant gain in computer literacy proficiency, from pre-survey to post-survey data, was found, $t(11) = -1.548$, $p = .075$. Given that the results of the paired t-test were not found to be statistically significant, it can be concluded that the program did not appear to increase the teacher candidates' computer literacy proficiency substantially. The results of the effect size for the paired t-test was $d = .4165$, which is considered to be a small effect size (Cohen, 1988).

FAMILIARITY WITH CURRENT AND EMERGING TECHNOLOGY DEVELOPMENT

Pre-Survey (N=63): Respondents' knowledge of current and emerging technology development was assessed by routine engagement in the following activities: reading technology-related magazines, subscribing to technology-related journals, attending technology-related courses or workshops, and attending technology-related conferences. The majority of the participants reported that they did not read (82.3%) or subscribe to any technology-related magazines (93.5%), nor did the majority attend technology-related courses (90.3%) or workshops (83.9%).

Post-Survey (N=12): No statistically significant gain in current and emerging technology development proficiency from pre-survey to post-survey data, was found, *t*(11) = .290, p = .389. The results of the effect size for the paired t-test was *d* = ..0643, which is considered to be a trivial effect size (Cohen, 1988).

PLANNING, INSTRUCTIONAL DESIGN, AND MANAGEMENT

Pre-Survey (N=63): Upon enrolling in the program, the majority of respondents reported minimal ability in applying technology to plan, design, and manage instruction. Similarly, students were not sufficiently versed in using technology to meet the individual needs of K-12 learners. The results showed 45.2% reported they were unable to design lessons that utilized technology to develop students' higher order thinking skills, 55.6% indicated they were incapable of teaching lessons that address the national, state, or local content area standards, and 66.7% testified they could not teach lessons enhanced by technology that addressed student technology standards.

Post-Survey (N=12): There was a statistically significant gain in planning, instructional design, and management proficiency, from pre-survey to post-survey data ($\overline{X}_{Pre} = 18.167, \overline{X}_{Post} = 31.583$), *t*(11) = -3.612, *p* = .002. The results of the effect size for the paired t-test was *d* = .1.023, which is considered to be a strong effect size (Cohen, 1988).

On the post-survey, seven (item #1, 2, 4, 5, 6, 7, 9) of the nine survey items in this category suggested that all students could perform the required task at some proficiency level. A small percentage of the participants continue to report having some difficulty with designing lessons that utilize technology to develop students' higher order thinking skills and teaching lessons enhanced by technology that address student technology standards. Table 3 represents reported proficiencies in planning, instructional design, and management that were considered sufficient increases or decreases.

ASSESSMENT AND EVALUATION

Pre-Survey (N=63): Regarding the use of technology to assess and evaluate K-12 learner performance, the majority of respondents reported feeling competent in this area, but most indicated that they required assistance to complete this kind of activity. Respondents were asked to identify their degree of competence and level of performance in applying technology to evaluate student learning, evaluate artifacts created by students via use of technology, track and interpret student progress (using electronic grade books or spreadsheets), communicate evidence of student progress, and guide students in the development of rubrics to evaluate products created using technology. The results indicated that 58.7% reported they were unable to use technology to evaluate student learning, 52.4% were incapable of evaluating artifacts created by students using technology, and 65.1% expressed that they could not guide students in the development of rubrics to evaluate products developed using technology.

Post-Survey (N=12): There was a statistically significant gain in assessment and evaluation proficiency, from pre-survey to post-survey data ($\overline{X}_{Pre} = 8.000, \overline{X}_{Post} = 17.167$), $t(11) = -4.492$, $p = .001$. The results of the effect size for the paired t-test was $d = 1.151$, which is considered to be a strong effect size (Cohen, 1988). Only two of the five survey items (item #2, 4) in this section of the post-survey reported that all students could perform the required task at some proficiency level. Table 4 represents reported proficiencies in assessment and evaluation that were considered sufficient increases or decreases.

Table 3. Sufficient Increases/Decreases in Planning, Instructional Design, and Management Proficiency

	% Pre-Survey	% Post-Survey	% Difference
1. Design lessons that use technology			
Self-taught/Can teach others	3.3	33.3	+30.0
2. Design developmentally appropriate lessons			
Formal instruction/Can teach others	8.1	41.7	+33.6
4. Design lessons utilizing technology to develop higher order thinking skills			
Can't do	45.2	8.3	-36.9
Self-taught/Can teach others	1.6	33.3	+31.7
Formal instruction/Can teach others	8.1	25.0	+16.9
4. Find technology resources to support teaching and student learning			
Self-taught/Can teach others	19.4	58.3	+38.9
7. Teach lessons that address national, state, or local content area standards			
Formal instruction/Can teach others	6.3	41.7	+35.4
8. Teach lessons enhanced by technology that address student technology standards			
Can't do	66.7	16.7	-50.0
Self-taught/Can do independently	3.2	33.3	+30.1
Formal instruction/Can teach others	3.2	25.0	+21.8
9. Teach lessons that use technology to meet the individual needs of students			
Formal instruction/Can teach others	4.8	25.0	+20.2

Table 4. Sufficient Increases in Assessment and Evaluation Proficiency

	% Pre-Survey	% Post-Survey	% Difference
1. Use technology to evaluate student learning			
Can't do	58.7	16.7	-42.0
Formal instruction/Can teach others	3.2	33.3	+30.1
2. Evaluate artifacts created by students using technology			
Can't do	52.4	0.0	-52.4
Formal instruction/Can teach others	3.2	25.0	+21.8
3. Use electronic grade-books or spreadsheets to collect, analyze, and interpret student progress			
Can't do	41.3	8.3	+33.0
Formal instruction/Can teach others	6.3	33.3	+27.0
4. Use technology to communicate evidence of student learning to students and their parents/guardians			
Can't do	33.3	0.0	-33.3
Self-taught/Can teach others	11.1	41.7	+30.6
Formal instruction/Can teach others	4.8	25.0	+20.2
5. Guide students in the development of rubrics to evaluate products developed using technology			
Can't do	65.1	8.3	-56.8
Self-taught/Can do independently	7.9	33.3	+25.4

RODUCTIVITY AND PROFESSIONAL PRACTICE

Pre-Survey (N=63): In the last section of the survey, respondents were asked about their use of technology to enhance student and teacher productivity and teacher professional practice. Questions covered such abilities as evaluating the impact of technology on student learning and progress, using technology to assist with classroom management, applying technology resources that affirm diversity; and protecting the privacy and security of students' work and images when publishing on the WWW. The results showed that 65.1% believed they were unqualified to evaluate the quality of software designed to assist students in meeting content standards, 61.9% reported that they could not assess the impact of technology on student learning and progress, and 73.0% expressed that they could not protect the privacy and security of students' work and images when publishing on the WWW.

Post-Survey (N=12): There was a statistically significant gain in productivity and professional practice proficiency from pre-survey to post-survey data

($\overline{X}_{Pre} = 12.546, \overline{X}_{Post} = 21.000$), $t(10) = -3.624$, $p = .003$. The results of the effect size for the paired t-test was $d = .6953$, which is considered to be a moderate effect size (Cohen, 1988). Only one (item #8) of the eight survey items on the post-survey showed that all students could perform the required task at some proficiency level. Table 5 represents reported proficiencies in productivity and professional practice that were considered sufficient increases or decreases.

Also, a statistically significant positive relationship was found to exist between computer literacy and pedagogical uses of technology for the pre- and post-survey results. The post-survey correlations display much higher results compared to the pre-survey correlations suggesting a greater relationship between what participants claimed their computer literacy proficiency level compared with their pedagogical uses of technology proficiency level was following program participation. Table 6 represents the results for the Pearson product-moment correlations.

Table 5. Sufficient Increase/Decreases in Productivity and Professional Practice Proficiency

	% Pre-Survey	% Post-Survey	% Difference
1. Evaluate the quality of software intended to assist students in meeting content standards			
Can't do	65.1	9.1	-56.0
Self-taught/Can do independently	12.7	45.5	+32.8
2. Evaluate the impact of technology on student learning and progress			
Can't do	61.9	18.2	-43.7
Self-taught/Can do independently	11.1	54.5	+43.4
3. Use technology to assist with classroom management and record keeping activities			
Formal instruction/Can teach others	4.8	36.4	+30.3
4. Teach students about the legal and ethical issues related to technology			
Self-taught/Can do independently	19.0	54.5	+35.5
8. Apply classroom management procedures to ensure equitable access to computers for all students			
Can't do	46.0	0.0	-46.0
Self-taught/Can do independently	25.4	63.6	+38.2

Table 6. Correlations Between Computer Literacy & Pedagogical Uses of Technology

	Pearson Correlation (r)	Significance
Computer Literacy with Planning, Instructional Design, and Management		
Pre-Survey		
Post-Survey	.751	.005
Computer Literacy with Assessment and Evaluation		
Pre-Survey	.412	.001
Post-Survey	.608	.036
Computer Literacy with Productivity and Professional Practice		
Pre-Survey	.427	.000
Post-Survey	.837	.001

CONCLUSION

This study is significant to the field of teacher education in several ways. It provides a model for other schools, colleges, and departments of education (SCDEs) to follow for examining their programs to improve them. Also, it provides pre- and post- baseline data about teacher candidates' background and use of technology, important information for understanding the technology backgrounds of teacher candidates enrolling in SCDEs. Finally, the surveys used apply ISTE's (2000) NETS*T standards as a framework which may be utilized by other SCDEs to help them determine how their teacher candidates are meeting the standards, as well as provide information about students' technology backgrounds and technology experience—vital information for developing quality technology instruction in any teacher education program.

FUTURE DIRECTIONS

Although faculty members plan to continue administering the pre- and post-survey to subsequent teacher candidates entering and completing the Secondary Education program at GWU, faculty have begun investigating newer tools and approaches (e.g., see Banister & Vanatta, 2006) which apply performance-based measures. Also, the ISTE conducted several "NETS Refresh Forums" (town hall meetings) for input about "refreshing" the National Educational Technology Standards for Students (ISTE, 1999b). The revised standards, the *National Educational Technology Standards for Students: The Next Generation* (ISTE, 2007), were adopted in 2007. It is likely that these forums will improve and change those standards, as well as serve as a framework for doing the same with the ISTE NETS*T.

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Appendix A:
Survey Instrument

Part A: Demographics
Please only select one circle for each category.

What is your gender?

- ○ Female
- ○ Male

What is your ethnicity (Please select all that apply).

- ○ American Indian or Alaska native
- ○ Asian
- ○ Black or African-American
- ○ Do not choose to indicate
- ○ Hispanic or Latino
- ○ Native Hawaiian or other Pacific Islander
- ○ White
- ○ Other ____________________

What is your age?

Highest educational level attained?

- ○ Bachelors Degree
- ○ Post Bachelor Certificate
- ○ Masters Degree
- ○ Post Masters Certificate
- ○ Professional Degree (JD or MD)
- ○ Doctorate

What is your area of concentration?

- ○ Secondary Education, Concentration: Art
- ○ Secondary Education, Concentration: Computer Science
- ○ Secondary Education, Concentration: English as a Second Language
- ○ Secondary Education, Concentration: Foreign Language
- ○ Secondary Education, Concentration: Mathematics
- ○ Secondary Education, Concentration: Science
- ○ Secondary Education, Concentration: Social Studies
- ○ Secondary Education, Concentration: English

- ○ Other area, please specify

Part B: Computer Literacy & Training

1. Computer Literacy For each item below, please indicate how you learned to do this activity (I cannot do this, primarily self-taught, or formal instruction) and the level in which you can do this (I can do this with some assistance, I can do this independently, I can teach this to others):

				Level in which you can perform		
	I cannot do this (then go to next question)	Primarily self-taught (then select level in which you can perform)	Formal Instruction(then select level in which you can perform)	I can do this with some assistance	I can do this independently	I can teach this to others
Correct a frozen (locked-up) computer	○	○	○	○	○	○
Copy and paste electronic files from one place to another (e.g., from one folder to another)	○	○	○	○	○	○
Sort data using a database program (e.g., FileMaker Pro or Microsoft Access)	○	○	○	○	○	○
Create a graph using a spreadsheet program (e.g., Microsoft Excel)	○	○	○	○	○	○
Paste graphics into wordprocessing programs	○	○	○	○	○	○
Edit images using graphic editing software (e.g., Photoshop, Paint)	○	○	○	○	○	○
Scan pictures or text using a scanner	○	○	○	○	○	○
Use digital cameras	○	○	○	○	○	○
Create multimedia presentations (e.g., HyperStudio, KidPix slideshows, or PowerPoint presentations)	○	○	○	○	○	○
Use FTP to transfer files from remote computers (e.g., WS_FTP, or Fetch)	○	○	○	○	○	○
Send attachments via email	○	○	○	○	○	○
Conduct searches on the World Wide Web (e.g., using Google or Altavista)	○	○	○	○	○	○
Adjust document orientation (e.g., landscape or portrait)	○	○	○	○	○	○
Use a spell checker in a word processing program	○	○	○	○	○	○
Create web sites using HTML code or authoring software (e.g., Macromedia Dreamweaver, Microsoft FrontPage, or Netscape Composer)	○	○	○	○	○	○

2. Current and Emerging Technology Development (IB, VA)
Please select Yes or No to indicate whether or not you <u>routinely</u> engage in the following activities.

Do you <u>routinely</u> engage in following activities?	YES	NO
Read technology-related magazines	○	○
Subscribe to technology-related journals	○	○
Attend technology-related courses or workshops to stay abreast of current and emerging technologies	○	○
Attend conferences to stay abreast of current and emerging technologies	○	○

<u>Part C: Pedagogical Uses of Technology</u>

1. Planning, Instructional Design, and Management For each item below, please indicate how you learned to do this activity (I cannot do this, primarily self-taught, or formal instruction) and the level in which you can do this (I can do this with some assistance, I can do this independently, I can teach this to others):

				Level in which you can perform		
	I cannot do this (then go to next question)	Primarily self-taught (then select level in which you can perform)	Formal Instruction(then select level in which you can perform)	I can do this with some assistance	I can do this independently	I can teach this to others
Design lessons that use technology to meet the individual needs of students.	○	○	○	○	○	○
Design lessons that are developmentally appropriate for students.	○	○	○	○	○	○
Design lessons that utilize technology to develop students' higher order thinking skills.	○	○	○	○	○	○
Find technology resources to support teaching and student learning. (e.g., conduct research on the WWW to locate reference information).	○	○	○	○	○	○
Evaluate the appropriateness of technology resources for supporting teaching and student learning. (e.g., assess the appropriateness of a web site for a group of students).	○	○	○	○	○	○
Teach in environments that range from one-computer classrooms to networked computer labs.	○	○	○	○	○	○

				Level in which you can perform		
	I cannot do this (then go to next question)	Primarily self-taught (then select level in which you can perform)	Formal Instruction(then select level in which you can perform)	I can do this with some assistance	I can do this independently	I can teach this to others
Teach lessons that address national, state, or local content area standards.	○	○	○	○	○	○
Teach lessons enhanced by technology that address student technology standards.	○	○	○	○	○	○
Teach lessons that use technology to meet the individual needs of students.	○	○	○	○	○	○

2. Assessment and Evaluation

For each item below, please indicate how you learned to do this activity (I cannot do this, primarily self-taught, or formal instruction) and the level in which you can do this (I can do this with some assistance, I can do this independently, I can teach this to others):

				Level in which you can perform		
	I cannot do this (then go to next question)	Primarily self-taught (then select level in which you can perform)	Formal Instruction(then select level in which you can perform)	I can do this with some assistance	I can do this independently	I can teach this to others
Use technology to evaluate student learning.	○	○	○	○	○	○
Evaluate artifacts created by students using technology (e.g., digital portfolio, video, online tests, multimedia presentations, websites)	○	○	○	○	○	○
Use electronic grade books or spreadsheets to collect, analyze, and interpret student progress.	○	○	○	○	○	○
Use technology to communicate evidence of student learning to students and their parents/guardians.	○	○	○	○	○	○
Guide students in the development of rubrics to evaluate products developed using technology.	○	○	○	○	○	○

3. Productivity and Professional Practice

For each item below, please indicate how you learned to do this activity (I cannot do this, primarily self-taught, or formal instruction) and the level in which you can do this (I can do this with some assistance, I can do this independently, I can teach this to others):

				Level in which you can perform		
	I cannot do this (then go to next question)	Primarily self-taught (then select level in which you can perform)	Formal Instruction(then select level in which you can perform)	I can do this with some assistance	I can do this independently	I can teach this to others
Evaluate the quality of software intended to assist students in meeting content standards.	○	○	○	○	○	○
Evaluate the impact of technology on student learning and progress.	○	○	○	○	○	○
Use technology to assist with classroom management and record keeping activities. (e.g. classroom gradebook, databases, etc.)	○	○	○	○	○	○
Teach students about the legal and ethical issues related to technology (e.g., acceptable uses, copyright issues).	○	○	○	○	○	○
Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.	○	○	○	○	○	○
Identify and use technology resources that affirm diversity.	○	○	○	○	○	○
Protect the privacy and security of students' work and images when publishing on the WWW.	○	○	○	○	○	○
Apply classroom management procedures to ensure equitable access to computers for all students.	○	○	○	○	○	○