From High School to College: How Prepared Are Teacher Candidates For Technology Integration?

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Abstract

State and national standards continue to prod teacher education programs towards preparing teacher candidates who are capable of integrating computer technologies into their teaching methodologies. However, providing experiences and resources for this type of teacher training necessarily relies on students possessing basics skills in computer use and having K–12 teachers who modeled productive technology integration in the classroom. While some high schools are managing to provide students with these skills and experiences, others are not, leaving teacher education programs to address the diverse levels of technological skills in their teacher candidates. This study presents a description of the categories of computer skill levels represented in a freshman class of teacher candidates and how these candidates characterize their high school experiences with computers.

As we continue to emphasize the importance of technology in education, teachers and administrators are working to address state and national (NETS•S) standards in K–12 classrooms (International Society for Technology in Education, 2004). Millions of dollars have been spent in equipping these classrooms with computers, software, and peripherals such as scanners, digital cameras, and printers. Additionally, resources have been allocated for technical support and professional development for teachers. To complement this emphasis in the K–12 environment, teacher education programs have been focusing on ISTE's NETS•T (National Technology Standards for Teachers) to prepare new teachers to enter K–12 classrooms ready to integrate digital technologies effectively (Kelly, 2002).

For the population of high school students embarking on a career in teaching, it is prudent to investigate how they are experiencing the transition from the NETS•S to the NETS•T. In other words, are skills and dispositions being nurtured in our nation's high schools that prepare teacher candidates to transition into fulfilling the NETS•T? Have these high school students been provided with challenging work in their K–12 tenure that integrated technologies in their curricula? Have they seen good models of teaching with technology? Have they been expected to use various technology skills and tools in their own learning? The answers to these questions can assist institutions of higher education, as they design programs that provide a smooth transition for those moving from the role of *student* into the role of *teacher*.

Of course, it is unrealistic to expect that high school students aspiring to become teachers are receiving identical educational experiences across the United States. It is possible, however, that upon investigation, some trends may be found that shed light on what knowledge, skills, and dispositions incoming freshmen teacher candidates bring from their high school experiences regarding technology and education. As these patterns are discovered, they lay the groundwork for further collaboration between high school and college faculties to strengthen their respective programs to support student achievement in relation to the NETS•S and NETS•T. The following paragraphs describe one college's attempt at assessing beginning teacher candidates' readiness for the NETS•T, and the relationship of this readiness to the teacher candidates' high school experiences with technology.

Our faculty has been collaboratively working toward systematically integrating the NETS•T in all our teacher education programs. Figure 1 graphically depicts our concerted efforts to infuse technologies throughout our four-year degree programs. Although we have made significant progress over the past six years, the large numbers of students we serve complicates our task. Our college of education serves more than 3,200 teacher education majors within four programs—early childhood, middle childhood, adolescent-young adult, and special education. Our institution is the largest producer of teacher-education graduates in Ohio, graduating more than seven hundred teachers a year. Faculty members were frustrated by varying levels of student computer skills evidenced in their coursework; although some students were able to complete course assignments requiring technology use, others needed a tremendous amount of tutorial support to create basic presentations or spreadsheets. In an effort to insure students would have basic technology skills at the beginning of their college career, we implemented an Assessment of Technology Competencies or ATC (http://edhd.bgsu.edu/atc/info). Before sharing the details of this particular experience in using performance assessment to document teacher candidate technology competencies, a brief review of the literature in these areas is presented.

Performance Assessment and Assessing Technology Competencies

In the United States, as well as other nations, educational institutions are being carefully scrutinized. Evidence of student progress is expected to be documented and distributed (Reeves, 2002; Whittaker & Young, 2002). The interest in accountability and continuous improvement has affected assessment processes in P–16 education, increasing the use of standardized tests as well as performance assessments (Bartlett, 2002; Brown, 2000; Kimball & Cone, 2002; Maribeth Gettinger-Gaide, 2001; Persichitte & Herring, 2002). Performance assessments are characterized by their focus on student products or artifacts that demonstrate certain skills or achievements that cannot be easily measured through traditional standardized tests. Portfolio assessment—and more specifically, electronic portfolio development—have grown out of a need for students to collect and organize multiple performance assessment products (Holt et al., 2001; Quatroche et al., 2002).

BGSU teacher education programs, as a part of meeting accreditation standards through the National Council for the Accreditation of Teacher Education (NCATE), have been developing key assessments (performance assessments) that provide evidence of teacher candidate competency

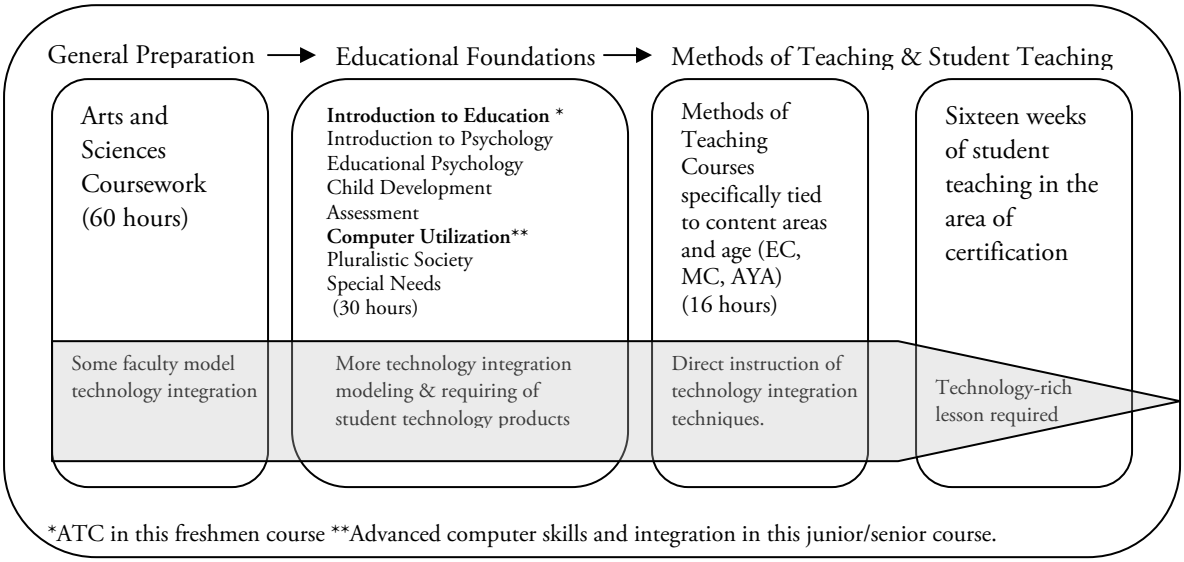

Figure 1: ATC (basic technology skills) & Advanced Technology Skills

throughout the core curricula. When the need for basic technology skills among teacher candidates was identified, developing a performance assessment to allow students to demonstrate their skills in this area seemed a reasonable solution. This assessment would then become a part of the key assessment documents that students would compile in an electronic portfolio format to document their professional development.

Some might argue that a skills-based technology assessment is inappropriate in teacher education and that curriculum integration strategies and higher-order thinking should be the foci. However, support for targeting skills first exists both in the current literature and in the ranks of teacher education faculty and administration. Early studies by the Apple Classrooms of Tomorrow (ACOT) researchers delineated five stages of teacher technology use. The ACOT studies identified these stages as entry, adoption, adaptation, appropriation, and invention (Sandholtz et al., 1997). In order for teachers to become effective technology integrators in their classrooms, they must first acquire the skills that would support the entry and adoption level work. The North Central Regional Educational Laboratory's Digital-Age Literacy initiative (NCREL, 2004) lists "technological literacy" as one of the eight vital literacies that students must possess to thrive in the 21st century.

Up to this point, many attempts at determining student and teacher technology competencies have relied on survey data (Collier et al., 2004). These self-reports are difficult to evaluate, and researchers cannot adequately document technology skill development through such means. K–16 educators have been grappling with the complexities of assessing technology skills in a real-world manner (Engstrom, 2004; Pearson, 2004). Such attempts are expensive and difficult to organize. Both IC^3 (Certiport, 2004) and MyTarget (MyTarget, 2004) are examples of national and regional attempts to address teacher technology competencies. Individual institutions of higher education are just beginning to develop procedures for identifying student computer skills (Gaide, 2004; Graham, 2004). It is within this context that our Assessment of Technology Competencies was born.

The Assessment of Technology Competencies (ATC)

The first tier of the NETS•T, "Technology Operations and Concepts," specifically points to the development of technology skills for teachers in areas of word processing, spreadsheet, presentation, Internet, and media (Kelly, 2002). Furthermore, development and demonstration of these skills are to be a part of the teacher candidates General Preparation phase of their program. Requiring students to demonstrate basic technology skills, and giving them support systems to strengthen their development of these skills, insures that they are poised to expand their use and understanding of educational technologies as they move into their Professional Preparation phase. Student survey data indicate that students are realizing the important role computer technologies will play in their future work as teachers, and were grateful for the initial prompting to master the basic skills they would need for their professional development.

Currently, the assessment is a four-page document that details the construction of three digital products to be completed by the student in a proctored, one-and-a-half hour session in the college's computer lab. The products utilize word processing, spreadsheet, presentation, and graphics software applications, and integrate Internet and file management expertise (Banister & Vannatta, 2005). These computer skills have been identified by ISTE, as well as our faculty, and are considered to be essential for first-year education students. Students receive a score based on a 40-point scale on completion of the assessment. If students are unable to successfully complete the ATC, they are allowed to retake the assessment the following month to earn a passing score.

Although four different versions of the ATC are used in this process, one particular version included a prompt in the word processing section asking students to write about their high school experiences and computer technology. The exact prompt reads, "In the left hand column, write one or two paragraphs describing how you used computers in your high school classes." Directors of the ATC began reading these essays and were struck by the varying descriptors shared by students. These teacher candidates' responses included statements such as "In my small-town high school, we had few computers." and "In high school we rarely used computers." In contrast, others related, "In high school I used computers everyday." One student shared,

> In our high school, teachers used computers a lot to show what they wanted to teach. Often teachers would use PowerPoint presentations to help with their teaching. This helps the visual students learn better. The teachers often assigned projects that we had to use computers to do.
>
> I personally used computers a lot in many of my projects. I made a PowerPoint presentation that was shown at a pre-prom assembly about not drinking and driving. This was shown to both the junior and senior classes. I also had to use computers to type all my papers for classes. We had many assignments with searching Web sites at our school also.

Obviously, these students had very different experiences and perceptions involving technology integration at their high schools. We wondered if these perceptions would correlate with the skills students were bringing to their college coursework.

Mode of Inquiry

In an effort to explore the relationships between student descriptions of their high school technology experiences and their technology skills as demonstrated on the ATC, we began reading and categorizing their essay responses. We divided students into two groups, one that we labeled "High Perception" and the other "Low Perception," in terms of their computer use in high school.

Two faculty members independently categorized student essays into the High Perception and Low Perception categories. Key phrases in student responses labeled High Perception of computer use in high school included "a lot," "everyday," and "many"; listing specific subjects where computers were used and mentioning computer classes that were offered at their schools also were indications of High Perception. Words used to place students in the Low Perception category included "none," "very little," and "never." In the event that a student essay did not provide enough information to make a judgment on High or Low Perception, that student was dropped from the analysis. This occurred for 9 out of 110 students during the first round of the assessment, and for 10 out of 126 for the retake round of the assessment. After independently categorizing all of the students, faculty members came together and compared results. We established a 100% agreement rate for the High/Low Perception categories. Examples of responses and the categories in which they were placed are noted in Table 1.

Obviously, this categorization is a simplistic way to group student responses on this topic, and more themes could be identified. Our goal was to look at the student scores on the ATC in comparison with their descriptions of their high school computer experiences, however, so this two-category system allowed us to do that.

Our next step was to match student scores on their ATC with their essay responses. For this task we divided students into two other categories, High Score and Low Score. Because the assessment consisted of four sections, totaling 40 points, we agreed that a score between 35–40 would be considered a High Score. If students scored below 35, they necessarily missed critical technology skills in the assessment, and we felt that the

Table 1: Examples of High and Low Perception Statements

How did you use computers in your high school?

High Perception	Low Perception
"In high school we were required to know how to use computers. All of our papers and other important documents had to be typed on a computer in order to be graded. Not only were we required to type all of our papers, but the school mandated that all of the students take a technology class"	"In high school my computer use was minimal. I basically on ly used computers for three things. The first was typing school papers. The second was browsing the Internet. Finally the third was for my semester in yearbook."
"I used computers in high school in many different ways…I mainly used computers to do research in high school."	"In high school, I barely ever had to use computers. When I did, it was for research. No type of computer class was mandatory, and I had better subjects to learn than computers skills…"
"Computers are a very important component of any high school experience. Not only are there papers to write and research, but also there are classes that revolve around computers…"	"In my high school we had three computer labs and a computer in every classroom. We were allowed to use the labs for homework assignments and research, nothing else. The classroom computers students weren't allowed to use at all, which we all thought was strange and unusual."

Low Perception/High Score "The technology used during my high school career, wasn't very complicated. There was. Of course, the old pc computer used. We had to do a PowerPoint presentation, and fill out a resume using a pre-set format, but other than that, there wasn't much technology used. Due to the affluence of my city, it was basically just assumed that a student had a computer to use back at home and didn't need to be taught how to use a computer, or surf the web. However, in order to graduate with honors, you were reuired to take half a credit of computer competency. I took a typewriting class." 40 points on ATC, retake only	High Perception/High Score "Having computers available for student use in high school is a great asset to both students and teacher/administration. I would always find time in study-halls to go down and type up a project or paper that was due next class. It was very convenient to be able to access a computer so easily in my school. Class activities were always more interesting and fun if they involved computer work. I actually learned more by doing projects, assignment and activities all on a computer. I noticed that I wasn't the only one. Now that I look back at it, I can appreciate it more for the experience of working with computers before I entered college." 35 points on ATC, retake only
Low Perception/Low Score "I used computers in high school mainly on a computer class level, meaning that other than that computer class, I didn't use any computers at all. I took an introduction to computer my freshman year and it was just the basics. That class was fun, but it was very elementary like how to turn on a computer and how to turn it off, basically. My senior year was the fun computer class I had. It was merely a class for outgoing seniors to get an extra credit before getting the diploma. Which was fun because everybody just goofed off everyday and had a ball and the teacher didn't care at all because she was right out of college and still knew what it was like to be on the other side of the desk." 15 points on the ATC, retake only	High Perception/Low Score "When I was in high school we were required to know how to use computers. All of our papers and other important documents had to be typed on a computer in order to be graded. Not only were we required to type all of our papers, but the school mandated that all of the students take a technology class. These classes taught students how to use all ot the windows programs. The administration recommended that students take this class as freshmen. This allowed students to use the skills they obtained in the technology calss to succeed in their other classes." 0 points on the ATC, first round 11 points on the ATC, retake

Figure 2: Example Data from Four Quadrants of Students Identified

Table 2: Distribution of students within identified categories

Category	First Round of ATC (100 students*)		Retake Round of ATC (116 students)	
Low Perception/High Score (LPHS)	10	10%	12	10%
High Perception /High Score (HPHS)	42	42%	27	23%
Low Perception /Low Score (LPLS)	16	16%	20	17%
High Perception /Low Score (HPLS)	32	32%	57	49%

only one-fourth of the 500 students had the test version with the prompt during the first round

Low Score category was an accurate descriptor of their performance. The rubrics for scoring the assessment had been piloted and validated the previous year and we were confident that the scores reflected the students' performance on the technology skills targeted. Once the High Performance/Low Performance information was crossed with the High Score/Low Score data, we identified four categories of students. Figure 2 notates these: Low Perception/High Score (LPHS), High Perception/High Score (HPHS), Low Perception/Low Score (LPLS), and High Perception/Low Score (HPLS).

Using these categories, we aggregated the results. Table 2 presents data from student ATC testing for both the first and second round of the assessment process. During the first round of testing, only one-fourth of the students (N=100) wrote about their high school technology experiences, as this prompt was only included in one (out of four) of the versions of the instrument. All students who didn't initially pass the ATC were allowed to retake the assessment a month later. All of these students (N=116) did write about their high school experiences, providing comparative data for the analysis presented.

We were quite surprised by this distribution. First, we had hypothesized that students relating poor high school experiences with technology would do poorly on the assessment (LPLS), and that students documenting a high regard for their high school technology experiences would do well on the ATC (HPHS). This was true for 58% of the students during the first round of testing, but only 40% of the students during the retake round. The drop in HPHS students in the retake round can be explained partially by the fact that many of the High Perception students passed the first round and did not need to retake. Why were students' perceptions not indicators of their abilities to pass a basic skills technology assessment?

Although 10% of students with poor high school technology experiences were able to pass the ATC (LPHS), our most intriguing finding was the large number of students who believed that they were well prepared in high school for technology use, but failed the ATC. The following discussion explores the factors that may have affected these results. The High Perception-Low Score (HPLS) phenomenon will be addressed first, followed by a conversation on the Low Perception-High Score (LPHS) group of students.

High Perception, Low Score (HPLS)

Students who described their use of technology in high school as strong, yet were unable to pass the basic skills test, often described their computer strengths in two areas: use of word processing and researching the Internet. For example:

> At XXXX High School the students used the computers frequently. We would often use them during class for writing papers, or simply searching the Web. There were many computer labs in the school, and almost every period they would be packed with students. If a teacher needed a computer lab for their class, all they had to do was simply reserve the room, and the students were free to use the computers. Technology was very important at XXXX High School.

Some students who we categorized as HPLS described their use of computers as skillful because of the amount of time they spend on computers at home. For example:

> In high school I used my computer for many things. I spent many nights on the Internet talking with my friends using Instant Messenger. I also used the computer to complete all my homework assignments. Having a computer helped me greatly. I was able to hand in documents that were neat and organized compared to my handwriting.

These statements indicate that students are using technology, but the computer uses they describe do not provide them with the necessary skills they will need in higher education. Faculty in the College of Education are expecting students to at least possess the basic technology skills of word processing, spreadsheet, presentation, and graphic software along with Internet skills and file management. Possession of these skills provides for the building block for students to work with other technologies such as digital video, handhelds, and electronic portfolio creation. Fluency in basic technology skills also provides the stepping stone for the discussion of technology integration within teacher education courses.

It is clear that students' definitions of what it means to be computer competent and the skills required in the NETS•S are not the same. The insight into these statements from high school students shows the need for collaboration between higher education and school districts to work together to address the NETS•S in the K–12 environment. School districts that are addressing the NETS•S should be graduating students who have a much more realistic perception of their technology skills in regards to computer competencies.

Low Perception, High Score (LPHS)

Students who described their use of technology in high school as weak or nonexistent, yet where able to pass the ATC test, are unique. How are students who have a low perception of their computer use in high school able to score high on a performance-based computer competency test in the first year of higher education? How did students acquire the skills necessary to pass the ATC test?

Some students categorized as LPHS described their schools as lacking technology, but they may have taken one class where technology was used, such as English, yearbook, or keyboarding. This exposure to computers may have provided a basis for students to pass the basic skills test. For example:

> At XXXX High School, computers were not an important aspect or our education. There were very few classrooms that had more than one computer. Most classrooms did have one computer for the teachers' use. However, there were a few classes that were computer based. For example, senior year English classes were all in computer labs because it was a writing class. Overall, computers were not part of our everyday class time at XXXX High.

With the anticipation that some students may not have had exposure in high school to the basic computer skills of the ATC, we put several mechanisms into place to help students work on the skills before taking the test. First, students were presented with information about the ATC during summer orientation before the fall semester. A Web site had been created for students to access information concerning the test (http://edhd.

bgsu.edu/atc/info/). A copy of a practice test and a practice test rubric was provided on the site. Students were able to download the test and practice the required basic computer skills before taking the ATC test. If students were having difficultly with the practice test, a link to video tutorials designed to cover the skills tested on the ATC was also provided. The ATC was open book and open note, so students who did practice and work on the skills were able to take notes and use them as a guide while taking the test. With these self-help instruments in place, students were able to learn the basic skills in a relatively short period of time to successfully pass the test.

Students who did not pass the test the first time were able to retake any part of the test that they failed. Before students took the test, they answered a short survey that addressed how they where able to acquire the skills that they failed previously. This survey data (N=417) was collected at the beginning of the testing session (Fall 2004) to elicit information regarding test preparation and utilization of ATC information. Although participants had received a packet of information describing the ATC during summer orientation, to our surprise 38% indicated that they did not read it. Only 16% of the participants read the packet and used it to prepare for the assessment. Students also received much information regarding the ATC during the first couple weeks of class. This information detailed resources available for ATC preparation. On the survey, five options of support were listed: practice test, online tutorials, support sessions, Student Tech, and other. Of the 417 survey participants, 67% used the practice test to prepare, while only 3–5% utilized support sessions or Student Tech. Interestingly, 32% used the online tutorials, and 43% used "other" resources, which typically referred to a knowledgeable friend or classmate. The top resource used to prepare for the retake was "other" (57%). Fifty percent of retake participants continued to utilize the practice test as well. The survey data suggests that perhaps students who had a low perception of their high school technology use and lacked technology proficiency were able to use various tools to acquire the basic ATC skills on their own, in a short amount of time.

Conclusion

From our experience in assessing teacher candidates in basic technology skills, it is clear that their exposure to the NETS•S is quite varied. The integration of digital technologies in their numerous high school environments ranges from exceptional to non-existent. Although this disparity is worrisome for all high school students, it is especially problematic for those aspiring to be teachers. The K–12 students who are not seeing technology integration being modeled in their schools are less likely to value this emphasis once they reach their teacher education programs. Colleges of education will have a difficult time convincing these students of the importance of investing efforts in demonstrating the NETS•T. If we are dedicated to truly transforming classrooms through the effective use of technologies in teaching and learning, then high schools and colleges need to work together more closely to find ways to bridge the gaps.

This study did not extend to the point of identifying specific high school programs and their uses of computer technologies. Research of this type needs to be conducted, connecting student performance in college to their previous experiences in high school. Researchers need to go beyond the students' self-reports and begin collecting data from schools concerning their technology experiences for students. Continuing to compare the high school program data with the student college performance data could help identify programs that are working. These programs could potentially be used as models for other high schools.

Although this study does show that college students can quickly acquire a set of basic computer skills after high school, it is more difficult to convince these students of the importance of technology integration within K–12 classrooms. Future teachers need to see effective K–12 computer utilization while they are students in this environment. Teacher education faculty with expertise in technology integration strategies should communicate with high school guidance counselors regarding the importance of technological competencies for prospective teachers. These higher education faculty members could serve as resources for high school teachers who desire more support in implementing the NET•S and modeling the NETS•T. High school and college faculties could begin to collectively strategize to create dynamic and effective technology experiences for students that support teaching and learning. Nurturing a dialogue that is open and mutually supportive, for the benefit of future teachers, could help these teacher candidates build a bridge from the NETS•S to the NETS•T. This type of collaboration has the potential to powerfully affect K–12 and teacher education. How shall we proceed?

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