Integrating Technology during Student Teaching: An Examination of Teacher Work Samples

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Abstract

This study examined the teacher work samples of 197 student teachers to determine their level of technology integration during student teaching. Findings indicated that most student teachers planned to use some kind of technology, although only 40% planned to include computers and less than 20% planned for the use of computers by students. The barriers to technology integration were most often related to instruction (e.g., the technology did not serve the learning goals and the technology was not developmentally appropriate) rather than a lack of available resources and time. These findings may be explained in part by the unique character of the teacher work sample (TWS) data, which prompts student teachers to report on their technology use during a single unit of instruction.

Preparing future teachers to integrate technology into their curriculum continues to present significant challenges for teacher education programs. Only one-third of teachers believe they are well prepared to use computers, and they credit their knowledge of computer use to independent learning first (93%), second to professional development activities (88%), and least to college or graduate work (51%) (NCES, 2000). Similarly, studies conducted within teacher education programs have yielded consistent findings. Shepherd, Rich, Wang, Deaton, Recesso, & Hannafin (2005) found no correlation between the number of technology courses taken and the ability of preservice teachers to integrate technology into the curriculum. Wang (1999) compared a stand-alone technology course to the integration of technology throughout the methods sequence and found that neither prepared preservice teachers adequately. Wang and Holthaus (1999) found that a high percentage of student teachers used computers during their field experience, but the low level of applications suggested significant deficiencies in their preparation.

The focus of this study is technology integration during the student teaching experience. The purpose of the study was to discover how many student teachers were able to integrate technology during student teaching, how technology was integrated during student teaching, and what prevented technology integration during student teaching. The primary source of data for this study were the teacher work samples (TWS) of 197 student teachers. The TWS is a performance-based assessment recently implemented by a number of teacher education programs in an effort to provide credible evidence of student teachers' ability to meet state and national teaching standards (Girod, 2002; McConney, Shalock, & Schalock, 1998; Schalock & Myton, 1988). The TWS prompt (The Renaissance Partnership, 2002) directs student teachers to design, teach, assess, and reflect upon a two- to three-week unit of instruction according to seven processes that are fundamental to high quality teaching. One of these processes is "Design for Instruction," which includes a section that explicitly prompts student teachers to describe their plan for technology integration.

The current study extends prior investigations by providing an alternative account of technology use during the student teaching experience. The conditions under which a TWS is completed differs from the observations, interviews, and surveys that have previously been used to document preservice teachers' use of technology in several key respects. The TWS descriptions of technology integration are written very close in time to when the instruction took place, are derived from a single specific unit of instruction completed during student teaching, and are supervised by a cooperating teacher and a university supervisor.

Theoretical Framework

Typically, two levels of technology instruction are recommended prior to student teaching: an introductory course in technology (Hargrave & Hsus, 2000) followed by the modeling of technology integration by faculty throughout the teacher education program (Duhaney, 2001; Krueger, Hansen & Smaldino, 2000; Pellegrino & Altman, 1997). Several studies have reported that a stand-alone course in technology can improve preservice teachers' dispositions toward technology and increase their awareness of instructional strategies for integrating technology into their future classrooms (e.g., Snider, 2002; Doering, Hughes, & Huffman, 2003; Benson, Farnsworth, Bahr, Lewis, & Shaha, 2004). Similarly, the efficacy of integrating technology use throughout the teacher education program has been demonstrated in a variety of contexts, (e.g., Pope, Hare, & Howard, 2002; Kariuki & Duran, 2004; Watts-Taffe, Gwinn, Johnson, & Horn, 2003). A high level of technology integration in a teacher education program would include (a) professor modeling and student practice, (b) an infusion of student and professor use across campus and field-based activities, (c) a consistent message that the primary importance of technology integration is instructional, and (d) an emphasis on the use and integration of a variety of educational technologies (Persichitte, Caffarella, & Tharp, 1999).

Regardless of previous preparation, however, technology integration during student teaching often depends on specific environmental factors. For example, Doering et al. (2003) followed ten student teachers who began their student teaching experience confident of their ability to integrate technology into the curriculum. By the end of the experience, however, seven of the ten perceived themselves to be unsuccessful due to either (a) lack of computer access, (b) difficulties with classroom management, (c) lack of technology support (appropriate software), and (d) lack of support from the cooperating teacher. Similarly, Bullock (2004) followed two student teachers whose attitudes toward technology reversed during student teaching. One participant began student teaching as a technology skeptic and changed to an enthusiast, because her cooperating teacher was a passionate advocate and highly skilled user of technology, resources were highly available, and parental and student expectations for technology use were high. In contrast, the second participant began eager to apply her knowledge of technology, but became frustrated with the lack of access to the computer lab and her teacher's view of technology instruction as peripheral to learning. Bullock concluded that the level of

technology integration during student teaching depends on how each individual responds to a variety of factors.

> No single factor appeared to be an overwhelming disabler or enabler. Instead, the combination of factors, especially the combination of attitude, experience, and modeling appear to have had the most influence on the decisions they made about how and when to use technology in their teaching. Though some of these factors fall within the control of the teacher preparation program, others like attitude and mentor teacher modeling do not. How a preservice teacher reacts to potentially disabling or enabling factors varies depending on all of the other factors they have encountered before or during their student teaching experiences (p. 220).

When technology is utilized during student teaching, the applications are frequently low-level and primarily teacher centered rather than student centered (Wang, 2002). For example, Dexter and Riedel (2003) surveyed student teachers within six months of their student teaching experience and found they were comfortable with their use of technology to complete professional tasks, somewhat comfortable with their ability to use it to enhance instruction, and were uncomfortable with their ability to troubleshoot problems with hardware and software. Of the preservice teachers surveyed, 84.6% indicated they used word processors frequently compared to 32.7% of their students, and 74.2% indicated they utilized the Internet frequently compared to 33.6% of their students. Student teachers also reported that twice as many computers were available for teacher (34.7%) versus student (14.2%) use and that technical support was more available than instructional support.

A number of approaches for improving the integration of technology during student teaching have been recommended, including: (a) setting high expectations (Dexter & Riedel, 2003), (b) encouraging student teachers to set goals for technology use (Dexter & Riedel, 2003; Vanatta & Fordham, 2004), (c) selecting and training the best cooperating teachers (Vanatta & Fordham, 2004), and (d) selecting technology-rich environments for student teachers (Dexter & Riedel, 2003). The plan for technology use within the TWS is consistent with these recommendations because it (a) sets the expectation that technology use is an important component of lesson planning, (b) encourages student teachers to set goals for technology use through their instructional design, and (c) provides a source of data for selecting technology-rich environments and knowledgeable cooperating teachers.

Methods and Procedures

Participants and Setting

The primary data for this study was collected from the teacher work samples of 197 student teacher participants, who completed their student teaching in the fall of 2004 at the University of Northern Iowa (UNI). The participants were spread across 71 different student teaching centers including 43 school districts in Iowa, 25 school districts in other states, and 3 at international schools. TWS's were collected from student teachers over a wide range of grade levels, including prekindergarten and kindergarten (n=29, 14.7%), 1st–5th grades (n=89, 45.2%), 6th–8th grades (n=43, 21.8%), and 9th–12th grades (n=36, 18.3%) and a wide variety of content areas, including special education, foreign languages, music, art, physical education, math, language arts, science, and social sciences. All 197 student teachers reported on a two- to three-week unit of their choice that was taught during the first eight weeks of a 16-week student teaching experience. Student teachers typically teach these units in the latter half of the eight-week session, thus giving them some time to become familiar with available technology. While completing this requirement, student teachers were provided assistance, guidance, and feedback by a faculty coordinator and a university supervisor who had received training on the TWS processes. At the time of this study, the TWS had been implemented for four years, so both cooperating teachers and university faculty were familiar with the process (see Henning & Robinson, 2004, for further details concerning implementation of the TWS at UNI).

Technology Instruction

The primary goal of technology instruction at UNI is to teach education majors how to design and develop technology-enriched learning experiences within the context of a thematic unit. Initial instruction is delivered at the sophomore level though a course entitled "Educational Media and Classroom Computing" to approximately 500 teacher education students annually. The course combines classroom and laboratory sessions to provide both practice with specific software and a theoretical context for technology integration. Preservice teachers are required to design and develop a thematic unit that provides a technology-enriched learning experience for K–12 students by (a) using electronic organizing software (Inspiration) to brainstorm activities for a thematic unit; (b) using an instructional design model to create or adapt a unit; (c) using spreadsheet software (Excel) to create a grade book as well as a learning tool that aligns with one of the unit objectives; (d) using multimedia authoring software (mPOWER) and Web page editing software (Mozilla Composer) to create products that facilitate student learning; and (e) preparing a Microsoft PowerPoint presentation to display and discuss an overview of their work. In the methods courses that follow, these skills are reinforced and more content specific technologies are introduced (e.g., graphing calculators) as specified by the UNI teaching standards (Office of Teacher Education, n.d., see Teaching Standard 3).

Data Collection and Analysis

The primary source of data was the "Design for Instruction" section of the TWS, which prompts students to "design instruction for specific learning goals, student characteristics and needs, and learning contexts." The Technology portion of the Design for Instruction prompt reads as follows:

> *Describe how you will use technology in your planning and/or instruction. If you do not plan to use any form of technology, provide a clear rationale for its omission* (The Renaissance Partnership, 2002).

In response to this part of the prompt, most student teachers wrote a paragraph or two regarding their plan for technology use, as shown in the example below:

> Technology is used in several ways in this unit of instruction. Students are able to access a Web site designed and maintained by the teacher, which includes activities for practice and review of information learned in the lesson. Students are able to do so from any computer, either during class review times, after school at the library study table, or from home. The overhead projector is another method of technology used quite frequently in the class. Answers to homework are copied onto transparencies so that students can correct the mistakes on their assignments. Transparencies are also used to show grammatical rules or to supplement conversations between the students and the teachers.

The first step in the analysis was to separate out the teacher work samples that did not report plans for using technology. These teacher work samples were not analyzed further. The second step was to summarize the types of equipment reported by the student teachers. For the most part, student teachers equated the use of electrically powered devices such as

computers, VCR's, and overheads with technology use. A very few claimed the use of non-electrical equipment as technology use (e.g., the white board). Those reports were not included in the findings for this study.

Next, computer use was examined using a constant comparative approach (Glaser & Strauss, 1967). First, we separated computer use by teacher or student use. Next, the specific kind of computer uses were recorded onto coding sheets (e.g., typing lesson plans, creating worksheets, or searching the Internet). From this summary data, we combined our data into categories. During this process, it became clear that our grouping of the data was influenced by how it was recorded. For example, recording the phrase "word processing" did not provide as much information as the phrase "typed lesson plans." Therefore, we reread each TWS a second time, using our initial categories as a guide to rerecord the data on revised coding sheets, and then to reexamine our initial categories. The resulting categories did not change significantly in character from the originals; however, a few individual items did shift categories, thus altering our final count slightly. A third reading of the TWS data verified our final tally.

A constant comparative approach was also used to code the reasons for not using technology. The first step in the process was to read them aloud and discuss them. From these discussions, a group of initial categories emerged, which were used as a basis for subsequent independent reading and coding of the remaining reasons. Each reason was read and coded by at least two researchers. Whenever a reason didn't seem to fit within any existing category or there was a difference among coders, the reason was discussed until a consensus on coding was reached. Following is an example of a student teacher who used some technology, but who also reported limited time and lack of available hardware as barriers to the further use of technology.

> I wish there was more use of technology during this unit. The problem was that there just weren't any resources available. The children were able to get their hands on a lot of books, but other than that all the technological things had to be done by me. I would have liked to have the children involved in scanning the pictures into the computer and seeing how the book was actually created but there wasn't any time left. The children had many field trips, events, and days off during the implementation of my unit. So, the lessons weren't consistently taught at the same time each day or given everyday. Another thing that created more of a barrier to the children using technology was the fact that the kindergartners didn't have access to a computer lab. There was one computer in the classroom that could be used during free-choice time but other than that the computer labs were on different floors on other parts of the building that were used for the older children exclusively. If the kindergarteners would have had access to computers, one thing I would have liked to have done was let them draw pictures of their vehicles in a paint shop program. Then maybe even let them create their own books on the computer. If my unit took place over the entire time I was in the classroom then we could have started early by exposing the children to computers slowly on a one-on-one basis then maybe by the time we were ready to make a book the children might have been ready to approach it one-on-one. However, logistics have to be considered and they play a large part in the implementation of units and lessons.

The example above is unique because the student teacher did more than the TWS prompt required. She not only explained her reasons for not using technology, she also specified how she would have utilized more technology had it been available.

Table 1: Types of Equipment Utilized by Student Teachers

Type of Equipment	Number	Percentage
Computers	103	40.7
Overhead Projectors	65	25.7
VCR/Projector	34	13.4
CD	12	4.7
Tape recorder	9	3.6
Calculator	8	3.2
Digital camera	4	1.6
DVD	2	0.1
Other	16	6.3
Total	253	99.3

List of Others: switches, projection map, scanner, motion detector, video camera, radio, microphone (2) LCD projector (2), scanner, laminator, stereo, metronome, tuner, hand held computer

Results

Integration of Technology into the Curriculum

Most student teachers (n = 142, 72.1%) planned to use some kind of technology in their teaching unit. The three most common types of equipment utilization incorporated into the Instructional Design by student teachers were computers, overhead projectors, and VCR's. Combined, they accounted for almost 80% of the technology designs in the teacher work sample. For a summary of equipment utilized by number and percentage, see Table 1.

Computer Use

Less than half of the student teachers included computers in their instructional design for their personal use (n=79, 40.1%). Of those who did, the three main personal uses included word processing, Internet searches, and PowerPoint demonstrations. Student teachers incorporated word processing programs in their designs to generate supporting materials (n=36, 18.3%), to prepare tests or other assessments or track student grades or attendance (n=27, 13.7%), to type lesson plans (n=17, 8.6%), or to communicate with parents (n=5, 2.5%). Of the 27 student teachers who incorporated computers for assessment purposes into their design, only three (1.5%) reported using specially designed software to track grades or attendance. Of the five who incorporated computers to communicate with parents, only one student teacher reported designing a Web site. None included e-mailing to communicate with parents. After word processing, student teachers primarily incorporated computer use to research their subject matter on the Internet (n=39, 19.8%) or to display Web sites (n=4, 2.0%). A few student teachers planned PowerPoint demonstrations (n=7, 3.6%). None of the student teachers included multimedia demonstrations. For a summary of the student teacher's personal use of computers, see Figure 1, page 74.

Fewer student teachers reported plans for student use of computers (n = 37, 18.8%). Student teachers reported designs that engaged students in activities either on the Internet (n=10, 5.1%), with software programs (n=9, 4.6%), or with an unspecified source (2). They also incorporated student research on the Internet (n=10, 5.1%), word processing (n=6, 3.0%), and PowerPoint demonstrations (n=3, 1.5%). Two student teachers indicated student use of the computer without providing enough details to make a more specific classification. For a summary of student use of computers, see Figure 2, page 74.

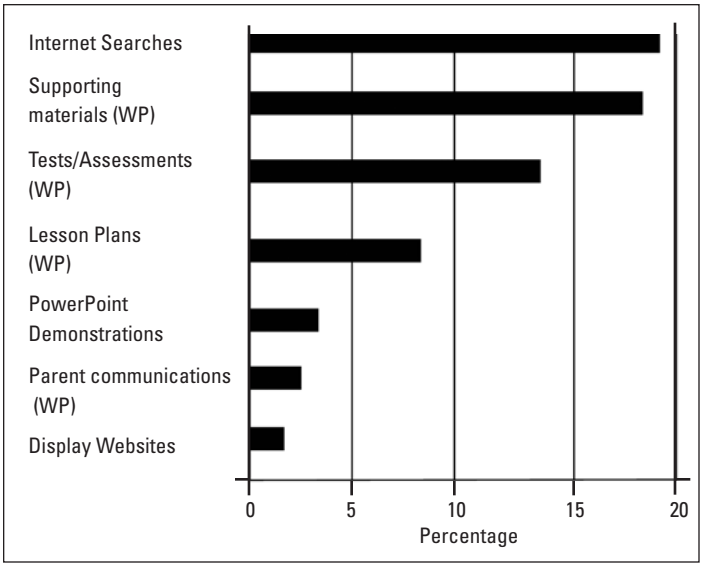

Figure 1: Type of personal use by percentage (WP = word processing).

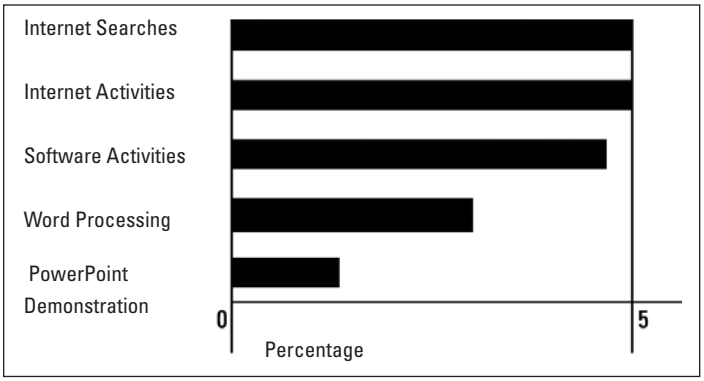

Figure 2: Type of student use by percentage.

A grade level comparison of student teacher and student use suggests a broad distribution of computer use. Student teachers at the earlier grade levels were more likely to plan lessons that incorporated the teacher's personal use of computers: prekindergarten and kindergarten (n=14, 48.3%), grades 1-5 (n=36, 40.5%), grades 6–8 (n=17, 39.5%), and grades 9-12 (n=12, 33.3%). Student teachers at the middle and high school level were more likely to plan lessons that included the student use of computers: prekindergarten and kindergarten (n=4, 13.8%), grades 1–5 (n=12, 13.5%), grades 6–8 (n=11, 25.6 %), and grades 9–12 (n=10, 27.8 %). The wide sampling of student teachers and the low numbers of student users precluded the discovery of any meaningful pattern of computer use by subject area. For a summary of teacher and student computer use by grade level, see Table 2.

Barriers to Using Technology

More than a quarter of the student teachers (n=55, 27.9%) either did not include a plan for their use of technology (n=37, 18.8%) or stated a reason for not using technology (n=18, 9.1%). A total of 67 student teachers gave 86 reasons for not incorporating any technology or for not incorporating more technology into their design. The reasons for not incorporating technology were coded into seven categories, which were grouped into two larger categories: "Barriers Related to Available Resources" (n=40, 46.5%) and "Barriers Related to Instruction" (n=46, 53.5%). Of the total number of reasons given, more than 60% were either related to a lack of available hardware or because the use of technology did not serve the learning goals. Below is a description of the seven categories and an example quote for each.

Table 2: Percentage of teacher and student use by grade levels.

	Teacher Use	Student Use
PK and kindergarten	48.3	13.8
Grades 1–5	40.5	13.5
Grades 6–8	39.5	25.6
Grades 9–12	33.3	27.8

Barriers Related to Available Resources

1. Availability of Hardware (n=25, 29.1%) Reasons included in this category cited lack of computers in the room, lack of access to the computer lab, and to a far lesser degree, outdated computers.

> [Technology] was not something that was used in the unit due to the fact that there were three computers in the class and 32 students. There was no guarantee that all the students would have been able to have computer time.

2. Lack of Software (n=9, 10.5%) The reasons in this category included explicit statements that the software needed for teaching the lesson was unavailable or did not match the learning goals for the unit.

> I did not use technology in any of the activities because the software at the school is very limited. Most of the software is related to reading and phonics. There was very little math activities I could have done with their computers.

3. Limited Time (n=6, 7.0%) Reasons given in this category addressed a lack of time in regards to length of the class period, the demands of the content in relation to the time available to teach the unit, and the requirements of the school district in regard to learning outcomes.

> Technology will not be used within this unit. This is due to the fact that I am tied into the district's curriculum map and must follow the projected curriculum for this unit. I need to meet all the requirements of the unit that has been specified by the district, and incorporating technology in the math unit was not envisioned and time does not allow me to do so.

Barriers Related to Instruction

4. Doesn't Serve the Learning Goals (n=27, 31.4%) Each reason coded in this category included a statement to the effect that the learning goals of the TWS unit would not be served by including technology. All of the reasons given were specific to the content of the unit.

> There are numerous resources that are available at [name of the school] to be used in the classroom. However, because of the content area and what the students should be doing during the unit, they never have hands-on with technology during this math unit. They have numerous other opportunities to use the technology resources in other content areas and they are utilized often.

5. Not Developmentally Appropriate (n=13, 15.1%) The reasons cited in this category were all given by student teachers of children in the second grade or younger; nine were given by student teachers of children at the kindergarten level or younger. The youngest group of students were one-year-olds. Two of the student teachers stated that the students weren't ready for the specific lesson; the other 11, like the example below, indicated the students were too young to use any computer application.

> With this age level the use of technology is limited and is not age appropriate. Four and five year old

students do not have the skills that are needed to operate a computer. They enjoy the use of teacher directed use of technology, but are not old enough to operate independently.

Other Barriers Related to Instruction

Two other reasons given for not using technology were coded as classroom management (n=1, 1.2%) and technology used elsewhere (n=2, 2.3%), a category in which two students indicated they had used technology in other subject areas rather than the one selected for completing the teacher work sample.

Discussion

Three of the primary findings from this study are consistent with the previous research literature. First, similar to previous studies (e.g., Doering et al., 2003; Bullock, 2004), this study found lack of hardware, software, or time to be barriers to computer use during student teaching. Second, the student teachers' use of computers far exceeded student use, by about the same 2–1 ratio found in the Dexter and Riedel's (2003) survey findings. Third, Dexter and Riedel found that word processing and using the Internet were two primary uses of the computer by both student teachers and students. Similarly, this study found that the three most reported student teacher uses for the computer were word processing, Internet searches, and PowerPoint demonstrations. The most reported student uses of computers included lesson related activities, Internet searches, and to a lesser degree word processing and PowerPoint demonstrations.

There were two notable differences in these findings compared to previous studies. First, more than half of the barriers to technology use (53.5%) were related to instruction. This finding was enabled by the context specific nature of TWS reporting, which requires students to address technology use within a specific unit of instruction. Second, the overall percentage of student teacher (40.1%) and student (18.8%) use of computers is much lower than the data reported by Dexter and Riedel (2003). They reported that 84.6% of the student teachers and 32.7% students used word processing, and 74.2% of the student teachers and 33.6% of the students used the Internet.

The lower reported use of technology in this study may be explained in part by the unique character of the TWS data. When completing a TWS, student teachers report only on a single unit of instruction, they are under the supervision of the university supervisor and the cooperating teacher, and reporting occurs during the student teaching experience close in time to when the computers were used. In comparison, the Dexter and Reidel (2003) study addressed the entire student teaching experience, reporting was unsupervised, and student teachers responded to the survey for as long as six months after the student teaching experience had ended.

Thus, for teacher education programs interested in program improvement, the TWS data can provide unique insights into the numbers of student teachers using technology, the level of use, and their rationale for not using technology. For example, in this study almost three quarters (70.3%) of the student teachers reported a plan for using some form of technology, none of the student teachers gave lack of technical skill as a reason for not integrating technology into their unit, and many of them incorporated multiple forms of technology into their teaching units. On the other hand, technology integration was often limited to low level applications, such as the use of overheads and VCR's, and almost 20% of the student teachers didn't report on technology at all. Further investigation is needed to determine whether technology integration could best be improved by addressing factors in the student teaching environment or by addressing the prior program preparation.

A potentially valuable source of information for such an investigation would be the student teachers' rationale for not using technology. For instance, in the Not Developmentally Appropriate category of barriers, student teachers referred exclusively to students who were in the second grade or younger. Further analysis could determine whether their rationale was based on a belief that that young children cannot benefit from the use of technology, a disposition that could be influenced through program preparation, or whether there was a lack of developmentally appropriate software to accomplish the specific goals of the lesson, an indication of limiting environmental factors.

Making that determination was often not possible in this study because the student teachers' explanations were lacking in detail. Therefore, we recommend that preparation prior to student teaching should alert preservice teachers to the barriers they will face, help them distinguish legitimate barriers from misconceptions, coach them on how and under what conditions they can overcome barriers, and provide guidance as to where they can seek professional support. This instruction could (a) better prepare student teachers to overcome technology barriers, (b) provide a way for them to demonstrate their knowledge when access is limited, and (c) improve the quality of TWS data. More importantly, this approach could also better prepare them to address the technology barriers they are likely to encounter as teachers.

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