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## What Students Want to Learn About Computers

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**A survey of students, parents, and administrators suggests that they want and need new approaches to teaching and learning with computer technology.**



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On a typical morning in early spring, the computer lab at Woodbury Middle School in Woodbury, Connecticut, hums with activity. Clustered around computer work centers in pairs or small groups, 25 students are completing the 8th grade memory book. The book integrates language arts, computer technology, and videoclips.

After taking a few minutes at the beginning of the period to explain some computer technology skills that students will need to use that day, computer teacher Jeff Turner moves around the room to monitor the students' work. When students ask him questions, he usually counters with another question to encourage problem solving. Sometimes he refers students to one of the project's Famous Persons—students who have emerged as tech experts in the skills needed to complete that day's work. Famous Persons, who are sometimes students with special learning needs or who have struggled in traditional academic subjects, rotate as the need for specific expertise changes.

When the class period ends, students reluctantly close up their work. At lunchtime, however, when the computer lab is open to students, many 8th graders return to work on the memory book. Over the last few years, the computer lab has become one of the school's most active and popular spots.

## Computer Technology in Schools

Student involvement with computers at Woodbury Middle School reflects the growing importance of computer technology in today's schools and classrooms. Over the last 20 years, computer technology has assumed an increasingly prominent role, and schools have gradually responded by helping children develop the computer technology skills needed in the global workplace. The Report on the Effectiveness of Technology in Schools (Software & Information Industry Association, 1999) estimated that by 1994, U.S. public and private schools, colleges and universities, and post-secondary training centers had purchased and installed 18.1 million computers. Despite this effort to acquire hardware, we have been less successful in identifying what computer skills should be taught in school and how computers can be used as a tool for teaching and learning.

Many schools are figuring out how computer technology can play a central role in teaching and learning. In addition to decisions about selecting, purchasing, and organizing computers and software, schools are wrestling with developing a computer technology curriculum, scheduling computer time, and providing professional development for teachers. With limited time and many instructional needs, fitting computer technology into the way we have traditionally conceived teaching and learning means another "add-on."

For computer technology in school to be successful, we need to change our approach. At Woodbury Middle School, for example, teachers use specific strategies for teaching and learning with and about computers. The school was one of six that participated in a recent study I conducted for my doctoral dissertation on students' beliefs about computer technology and experiences in using computer technology (O'Donnell Dooling, 1999).

As a middle, and later an elementary, school principal, I was concerned that we effectively address all children's computer technology learning needs. Computers have entered the school curriculum largely in response to societal changes, and many children arrive at school with extensive knowledge about using computers. I also noted a gender difference in children's voluntary access to computers during open lab time. Despite existing data on gender differences in math and science, I found little research on gender differences in computer technology and I wanted data that would inform my practice.

I chose to study children in grades 4 through 7 because the research on gender differences in computer technology had focused primarily on older students. I wanted to see how and when gender differences in computer technology emerged. I looked for participants from three elementary and three middle schools that were in the same socioeconomic stratification categorized by the state department of education. One hundred and seventy-six teachers, 9 administrators, and 1,427 students (with parental permission) volunteered to participate in the study.

Some of what we learned from the study confirmed perceptions widely held by many educators. Other findings offered unexpected and helpful insights into children's and teachers' experiences with computer technology. The study also led to connections with other schools that use innovative strategies for teaching and learning with computer technology.

## **What Students Said**

Through inventories, surveys, and handwritten technology autobiographies, the students who participated in the computer technology study provided rich and detailed descriptions of how they first learned about computers, how capable they felt about using computers, their experiences with computers in and out of school, and their expectations for future computer use. The descriptions were surprisingly consistent across grades 4 through 7 and participating schools. Among the broad conclusions of the study were the following:

*Boys and girls frequently learn about computers from more experienced persons, starting at an early age.* Experiences with computers began early for most children, often at home. Children most frequently cited their fathers as the family member who taught them about computer technology, but students also mentioned mothers, siblings, extended family members, neighbors, friends, and parents' coworkers. According to the students in the study, one-on-one instruction with a more experienced person provided powerful and lasting learning experiences. One 6th grade girl recalled a computer experience from early childhood:

I sat on my dad's lap and he would tell me what to click or press. I guess that is the way I learned to use computers because from that period on, I was able to use computers. Since my dad was always helping me, I was able to remember what to do.

*Students in grades 4 through 7 also enjoy learning about computer technology through independent exploration.* Roughly 30 percent of participating students said that they most preferred to learn about computers by simply trying to figure things out by themselves, or with the support of a text or manual. One 6th grade girl noted, "I personally prefer to explore the computer on my own. I learn by doing, not by listening." Concern for peers motivated a 5th grade boy who preferred to learn about computers alone: "That way, if I don't get it, I won't be embarrassed or shy. Also, if I get it faster than the others, they won't feel bad."

*Students generally expressed confidence in their ability to use computers, but there is evidence of gender differences in these beliefs.* Both boys and girls rated their capacity for using computer technology successfully as strong. They believed that they were capable of learning to use computers effectively and that computers were meant for everyone. However, reflective of similar patterns in math and science, some students (more boys than girls, and up to 10 percent of a given student population) believed that computers were a male domain. One 4th grade boy said, "girls shouldn't use computers. It's too technical. Girls will probably screw it up."

*The effectiveness of computer technology experiences at school depends on the student's prior knowledge, the teacher, access to hardware and software, and scheduling.* For children who had not had rich computer technology experiences outside school, the classroom and the computer lab became gateways to computer technology, with positive and negative effects. At school, students began to see the computer as a tool rather than as entertainment. A 5th grade girl reported that "at home, I thought of computers as a toy. But as we began to use them in school, I knew they were helpful in many other ways." Nonetheless, a 6th grade girl lamented the schedule, noting "in school this year, I didn't have a computer at home and I didn't really like computers because we had so many things to do and so little time."

The classroom teacher's expertise and enthusiasm for computer technology also had a direct impact on students. "My [classroom] teacher is a computer fanatic," wrote a 4th grade boy. "She gives my class many assignments on the computer. My computer teacher teaches us about new, advanced technology. Both of them give us support."

Finally, children who had rich computer experiences outside school held teaching and learning about technology in the classroom and computer lab to a high standard, particularly if instruction occurred within a traditional model. As a 6th grade boy wrote, "Teachers are too slow when teaching about computers. Whenever there is a person still failing or not doing well in an area, everyone is stopped where they are and we all work on that area until [the person] has caught up."

*Not all computer learning at school happens during formal instruction.* During class, lunch, and recess, children exchanged tips and shortcuts for using software, gave recommendations for purchasing computer games, and argued the relative merits of hardware upgrades. More subtle learning also took place when students observed how school personnel regulated access to computers. Schools need a careful plan for granting access to classroom computers and the computer lab to prevent inequities. In the words of one 4th grade girl, "My school has at least two [computers] to a classroom. I never get to use the school computers because all the boys in my class hog them."

*Students believe that computers are helpful and that they will use them more in their future workplaces than in school.* Boys and girls believed that computers were essential to their future success. According to a 4th grade girl, "Whether you work at McDonald's or the White House, you'll use computers." However, students less frequently cited the need to use computers for schoolwork. One 6th grade boy stated, "I don't think I will use computers a lot in school because I haven't used computers a lot yet."

## What Teachers Said

The computer technology study also sought the perceptions and experiences of teachers through responses to inventories, surveys, and interviews. Collectively, participants in the study and in follow-up research reported several common themes:

*Within any school or grade, the level of teacher proficiency with computer technology varies greatly. In some cases, the students may know more than the teacher.* Both classroom teachers and computer teachers acknowledged the broad spectrum of teachers' computer skills, as well as the discrepancy between the technology skills of the teacher and those of some students. One middle school teacher wrote, "It takes some time to overcome 'computer phobia.' Having a computer in my classroom has led me to experiment, learn, teach myself, and have students teach me."

*Students bring to school considerable experience with computers, but these skills are often software-specific and game-oriented.* Teachers noted that students' skills are understandably linked to the students' individual experiences. As a result, students often acquired competence in the basic functions of computer and software programs, leaving the school to teach about more complex computer tools and techniques. In addition, student expertise was frequently associated with computer games, resulting in skills with limited educational applications.

*Computer curriculums may vary substantially from school to school.* Teachers, students, and administrators most often perceived the computer curriculum at their school to be a recent work-in-progress that focused on basic skills, especially keyboarding. Schools more experienced in integrating computers with other curriculum areas viewed computers as tools. They believed that curriculum integration was both instructionally effective and efficient, and they valued authentic learning experiences with technology.

*If we want children to learn technology, they've got to use technology.* At Shepaug Valley Middle/High School in Washington, Connecticut, computer teacher Ted Roth arranged the computer lab hardware on mobile carts. Half the time, the computers remained in the computer lab for whole-class demonstrations. The remaining time, children used the computers for grade-level assignments in classrooms. Woodbury Middle School computer teacher Jeff Turner also advocated the importance of hands-on learning. "Kids have to play with, smell, and touch computers."

## What Schools Might Do

As schools seek needed hardware and software, educators are working to develop new models for teaching and learning with computers. The practices of schools that participated in the computer study and several other schools involved in follow-up research offer ideas.

*Integrate curriculum to use computer technology as a tool for teaching and learning.* Students appreciate learning experiences that are authentic and relevant. When computer skills are taught on a need-to-know basis within the context of a content-area assignment, students can apply and reinforce their new knowledge immediately. Jeff Turner says that if he provides direct instruction for more than five minutes, "I'm wasting students' time." Instead, tackling one or two new computer skills a day helps students build complex knowledge gradually.

This approach results in remarkable student performance. At Middlebury Elementary in Middlebury, Connecticut, 2nd graders use art software to produce scientific drawings of penguins during their study of Antarctica, and 4th graders chart and graph the growth of their paperwhite bulbs using spreadsheets. At Shepaug Valley Middle/High School, 8th graders publish a newspaper to complete their study of the Great Depression, and 12th graders submit an exit

portfolio which demonstrates eight district computer technology competencies. The work contained in the portfolio must include diverse, authentic classroom assignments from grades 9 through 12.

*Redefine the role of the teacher.* Computer teachers are assuming the role of facilitator. They still explain and model computer skills for students, but they often invite others into the classroom to share in instruction. They welcome divergent thinking and are quick to acknowledge that they are learners, too.

Students can also be teachers. Computer teachers, such as Dar New at Silver Beach Elementary School in Bellingham, Washington, and Ted Roth at Shepaug Valley Middle/High School, train interested students to assist teachers and other students with computer instruction. New has trained seventy-five 4th and 5th grade Tech Tutors and assigned them to each K–3 classroom to assist staff and students. They also work with senior citizens who come to the school to learn about computer software and the Internet. High school students on Roth's Tech Team meet during the week to learn new skills and problem-solving strategies. Then the students assist teachers and students during class and accompany Roth when he presents teacher inservice programs.

From a child's birth, parents are teachers. Beyond the computer skills that they share at home, parent volunteers can provide one-on-one coaching in the computer lab. At Middlebury Elementary, while the computer teacher instructs the class, two trained parent volunteers and the classroom teacher assist students as they use new skills to complete classroom assignments.

*Provide all school staff with ongoing professional development linked to authentic work.* As with students, teachers and staff should learn computer skills as they perform real work. At Middlebury Elementary School, computer teacher Sallie McMullen's inservice course teaches staff to use presentation software for classroom instruction and to create teaching materials, lesson plans, grading systems, and performance tasks. When Oxford Center School staff in Oxford, Connecticut, began to plan their computer technology inservice time, they worked with a parent who assisted with the training and arranged for sessions to be held at his place of employment, a local telephone company.

*Elicit the support of administrators, parents, and the community.* Given the fast-paced rate of computer technology evolution, helping our children develop competence in this area is a daunting challenge. Although children come to school with some measure of computer knowledge, many variables influence whether they will learn more about computers at school. A successfully passed budget, a donation of hardware from the business community, a parent volunteer, and a principal's efforts to fine-tune the schedule all directly shape the computer experiences of our students in school.

Back at Woodbury Middle School, Jeff Turner is already looking beyond the 8th grade memory book to where the computer curriculum might lead. He envisions student work in interdisciplinary portfolios that include animation, sound effects, and video. He'd like to connect students more closely to the community by doing such work as developing touch-screen menus for local restaurants. He's considering creating a town Web site that would feature oral histories by local senior citizens. If the enthusiasm of this teacher and his students indicates things to come, the future of computer technology in school—and of our students and communities—looks very bright, indeed.

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If you want to learn Computer Science and you're just starting out, you probably have a lot of questions. What programming languages should I learn? Is it enough to learn one or two programming languages to secure a good job at a big tech company? What other skills do I need, if any? With so much information out there, aspiring software engineers can find it difficult to ferret out the valuable information from the rubbish. Computer Assisted Learning encompasses a lot of different technologies and ideas, but can be understood easily enough. The Intense School, which focuses on computer and information technology, summarizes it simply as "the use of electronic devices/computers to provide educational instruction and to learn." It might shock you to learn that some form or another of Computer Assisted Learning has been taking place in classrooms since the 1960s. Again, the feelings of success and satisfaction are key to encouraging students to want to learn more. Because of this, CAL is a great method to use in the classroom. Students can easily see the progress they're making.