

# **Implementing Technology in a Fifth Grade Classroom: School and Home Perspectives**

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(Abstract)

This descriptive case study investigated the effects of widespread availability of information technology in a fifth grade classroom using a constructivist paradigm. The same computer configuration that students used in the classroom was provided for them at home, along with an Internet dial-up connection. The technology was used as an adjunct to the classroom and was utilized when appropriate. In addition to general classroom observations, four students were chosen for closer study. Their progress was monitored throughout the year with respect to three emerging themes related to information technology use: self-directed learning, collaboration, and social interaction.

The results of this study were organized into individual student stories with each theme explored. The results showed that the students used the available technology both in the classroom and at home. There was a natural fit between the requirements of the fifth grade class and the available tools. Students chose to utilize the available technology and derived new ways of doing so, particularly at

home where they were totally self-directed. For the students in this study, learning became a two-way process. Skills students developed on their own were shared with their teachers and other classmates.

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## Chapter 1: Introduction and Rationale

Information technology is significantly impacting society. A new “information age” has resulted in widespread use of these emergent technologies both at work and home. In common use today are e-mail, the World Wide Web and all its resources, as well as multimedia systems that allow users easy access to rich media content from their desktops. Public schools have and will continue to reflect societal change. Thus, as information technologies are becoming a natural part of our daily lives, their use in schools is becoming necessary and prevalent. A federally funded project, “PCs for Families,” the focus of this study, examines the effects of large-scale deployment of technology, both in the classroom and at home. As a participant observer, I monitored the unfolding results of the technology-rich environment made available to one group of twenty-four students and their teacher. To get a detailed picture, this study focused on four carefully chosen students who reflected several interesting facets of the classroom experience.

Technology has always impacted education; the printing press allowed textbooks to be developed, and the replacement of slates and chalk by pencil and paper permitted a permanent record of one's writing to be preserved. In the late 1950s and 1960s, television was

utilized as a means of teaching large groups of students, albeit ineffectively.

Today, a new wave of technology is beginning to cause repercussions in schools. That wave may change how students are taught. The technology centers on the personal computer and an Internet connection. Education is being partially transformed by new technologies. At one time students could learn a small, but fixed body of knowledge. Today, however, the enormous amount of available information, coupled with the fact that the existing knowledge in the world continues to double at an ever-increasing rate, requires a transformative approach to education. It is important that the students of today learn how to evaluate, manage, and use information, not merely regurgitate it (Mann, 1994). It needs to be determined whether or not information technology can facilitate this process. The purpose of my study was to investigate this question, and to gauge the effectiveness of information technology in the elementary classroom setting.

In order to prepare for the possible restructuring of schools to better reflect societal changes, much more must be learned about how educators can effectively utilize the power of information technologies. It must be remembered, though, that in the early 1950's, the same predictions were made about television, predictions that did not prove

to be true. As technology edges into the classroom, we do not know all of the potential impacts that technology has on teaching and learning, but we must deal with the ramifications of those impacts.

One local school division has pioneered the incorporation of information technologies into the classroom. Partnered with a community-networking project and a local major research university, the school division has been afforded opportunities to participate in several federally funded grants whose primary focus has been the application of information technology in the classroom milieu. One such project, "PCs for Families," is the focus of this study.

"PCs for Families" was a Field Initiated Study (FIS) funded by the Department of Education in Washington, D.C. The project was awarded to Dr. Monte Mackem, Computer Science Professor at a local university with participation by a nearby school, specifically Hawthorne Elementary (pseudonym). Goals of the project include acquiring hardware and software for one fifth grade classroom and the homes of the students in that classroom. The equipment was used to enhance instruction, extend the learning environment, and help facilitate communication between home and school. In addition, the classroom instruction integrates subjects and a constructivist paradigm guides instructional decisions. The project seeks to find out what impact this

technology-rich environment will have on one group of twenty-four fifth graders and their teacher.

This is the report of a case study undertaken by the author. The case study is one aspect of the much larger Field Initiated Study. It tells the story of a unique classroom, one replete with state-of-the-art technology, and the effects of this milieu on the learning of four children. Particular focus is given to three areas: self-directed learning, collaboration, and social interaction and how technology impacted them.

## Chapter 2: Theoretical Support for the Project

The published literature related to this study focuses on two topics—a theory of learning called constructivism and the integration of technology into the elementary school learning environment. The complexity of the multiple factors that must be considered in assessing the impacts of the FIS project on the student's life are the cause for investigating the different fields.

### **Constructivism**

Constructivism as a theory of learning has been widely studied over the last century. It is the belief that one constructs knowledge from one's experiences, mental structures, and beliefs that are used to interpret objects and events. Dewey (1897) stated:

The child's own instincts and powers furnish the material and give the starting-point for all education. Save as the efforts of the educator connect with some activity which the child is carrying out on his own initiative independent of the educator, education becomes reduced to a pressure from without. It may, indeed, give certain external results, but cannot truly be called educative. (p.23)

Constructivists believe students are active in their seeking and constructing knowledge and that they come to classroom with innate curiosities and goals (Piaget, 1954). Social constructivists extend this belief by highlighting the importance of social discourse and explain that social interaction guides students' thinking and their development of schema or concept formation (Vygotsky, 1962). Social discourse helps students construct and test hypotheses against their known reality and assists them in viewing knowledge and information from multiple perspectives (Vygotsky, 1978).

Piagetian theory emphasizes the role of self-discovery and peer collaboration (Piaget, & Inhelder, 1969), while Vygotskian theory stresses the role of interaction between novices and experts. Vygotsky focuses on where important learning takes place—the “zone of proximal development” or the “region of sensitivity to instruction.” During this interaction between novice and expert, it is not only knowledge and skills about a task that are acquired, but more importantly the competence in “self-regulation” where the process of instruction becomes “internalized” (Vygotsky, 1978).

To Piaget (Piaget & Inholder, 1969), instruction plays a less important role. His emphasis is on the active, self-construction nature of learning. Using technology as tools to support knowledge construction, where the learner controls the technology and not vice

versa, can be traced to Piagetian theory as can the importance of collaboration in learning (Bruner, 1971, Pappert, 1980).

Constructivism is child-centered; it proposes that learning environments should support multiple perspectives or interpretations of reality. Constructivism is focused on knowledge construction—facilitated by context-rich, experience-based activities—rather than knowledge reproduction (Jonassen, 1991).

An important component of constructivist theory is the focus of a child's education on authentic tasks. These are tasks, which have real-world relevance and utility for the child. The tasks are integrated across the curriculum and provide appropriate levels of difficulty or involvement. Because it would be impossible for us all to become masters of all content areas, instruction is anchored in a meaningful, real-world context (Jonassen, 1991).

### **Constructivism in a Technological Setting**

During the 1990s, constructivism as a theory of learning has been widely discussed when considering the use of technology in classrooms. It was learned early on that the mere presence of technology in the classroom, either as a method or product, did not demonstrate any marked difference in student attitudes or achievement (Roblyer, 1996). Thus, current research in uses of technology as tools for learning rarely focuses on the computer-

assisted instruction (CAI) popular in the 1970s and early 1980s based on the behavioral model of Skinner (Wood, 1995). Widely studied during that era, CAI was primarily used for skill-and-drill exercises that provided instant feedback. Basic arithmetic and word recognition skills were popular choices for CAI software. This was, however, an expensive proposition because an electronic worksheet was not cost effective even though some studies suggested that the results of CAI were often superior to traditional instructional methods of the day (Bangert-Drowns, Kulik & Kulik, 1985; Kulik & Kulik, 1991; Herman, 1994).

The focus of studies in the last few years have shown that schools have evolved away from using CAI to other, more interactive types of technology where learners have much more control and decision-making opportunity. Word processing can be effectively used by children of all ages; in many school districts, it is used as early as kindergarten. In one study, a group of second grade students showed improvement in general writing skills using a word processor. The paper-and-pencil-bound control group did not. In addition, the group using computers wrote longer compositions. When the tools used by the second graders were switched, the group first using a word processor continued to write well using paper and pencil, and the second group improved when using the computer (Jones, 1994).

Also becoming popular are New Information and Communication Technologies (NICT). These new technologies generally encompass the use of a computer which, when coupled with other technologies provide a virtually unlimited and diverse quantity of data that can be transmitted to any location in the world that has the capability to receive it. Many forms of this new technology exist. These include text, audio, scanned images, digital images, animation, full-motion video, as well as diagrams and graphs. Because these are new technologies, they must be examined differently from older technologies often found in public schools. In most cases, these new technologies are found in pilot projects or funded experiments (Bracewell & Laferrière, 1996).

A 1995 report by the US Congress Office of Technology Assessment noted, "It is becoming increasingly clear that technology in and of itself does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction" (US Congress, Office of Technology Assessment, 1995). Other researchers have offered this caution, as well (O'Neil, 1995 and Guthrie & Richardson, 1995). Strommen & Lincoln (1992) state, "The key to success lies in finding the appropriate points for integrating technology into a new pedagogical practice [constructivism], so that it supports the deeper, more reflective self-directed activity children must use if they are to be competent adults in the future." Campoy (1992)

emphasizes that the educational focus is on learning and instructional goals. The emphasis is not on the technology itself because technology are merely tools or vehicles. Thus, the perspective of educational researchers and practitioners concerning the role of new technologies has taken a significant shift in the last several years (Bracewell & Laferrière, 1996). In other words, computers and technology should not be viewed as “add ons,” but as tools which are an integral part of a child’s learning experience.

Barr’s (1990) five goals essential to meaningful educational reform apply here. He states that learning should be more:

1. independent;
2. individualized;
3. interactive;
4. interdisciplinary; and
5. intuitive.

Barr (1990, p. 81) goes on to say that resources in a typical school library are usually quite limited and “often impose artificial restrictions which limit the potential for genuine exploration and discovery.” In addition, with current knowledge having a shelf life of approximately one and a half years, many library materials are out of date or incomplete. Available resources via new technologies now include electronic data bases with current information and other

independent research tools formerly available only to the most sophisticated research environments.

One consideration often overlooked by researchers is whether students have the knowledge, skill, and training to use information technologies. Studies in which preliminary training is not provided to the students show a sharp contrast in the achievement of students when compared with studies that do provide initial training to them. Two studies illustrating this contrast are a study by Joram, Woodruff, Bryson, & Lindsay (1992) in which students had little training in using a word processing program and another by Owsten, Murphy, & Wideman (1992) where students had over a year's experience using the program. The Owsten, *et al* study where students were given prior training showed that students made greater gains in the quality of compositions when utilizing available technology.

### **The Role of Technology in Learning**

What role do these new technologies play in the learning process and on the learning environment? The remainder of this review will focus on five themes:

1. the learning achieved by students;
2. the effects of these technologies on students' motivation;
3. the student relationship to learning; and

4. the effects of technology on students' attention span and concentration; and
5. the effects of new technologies on students' abilities to practice inquiry and collaboration and on problem-solving skills.

### **Learning Achieved by Students**

Several observations have been made in regard to the effective use of new technologies by students. One such observation is that these new technologies can stimulate the development of reasoning and problem-solving skills as well as learning how to learn skills, and creativity (US Office of Technology Assessment, 1995). The CSILE project (Computer Supported Intentional Learning Environment) examined the effects of new technologies on student achievement. CSILE reports that "different pedagogical uses of the technology have shown differences in student performance on strategic skills" (Scardamalia, Bereiter, Brett, Burtis, Calhoun, & Smith Lea, 1992).

### **The Effects of Technologies on Student Motivation**

Another observation borne out by many studies is that new technologies can contribute to better learning in various subjects in several ways. Riel and her colleagues have studied the use of networked communication systems by elementary students as part of the language arts curriculum where students participated in authentic composing tasks for a real-world audience. At year's end students

were administered the *Comprehensive Test of Basic Skills*. An average gain of three grade levels in language mechanics and two grade levels in language expression was demonstrated. Reading comprehension and mathematics subtests showed a gain of the expected year's growth. Students in upper elementary participated in another project where they corresponded with adults by e-mail. At the end of the year, students' reading comprehension tested at two years above grade level, while reading vocabulary and written expression were 1.5 years above grade level. The increased scores in reading over writing were attributed to the students having read far more e-mail than they composed. (Riel, 1990).

A longitudinal study conducted in New Zealand concluded that students showed greater learning in English, mathematics, and science after participating in a program that included three elements: use by each student of a computer at least three hours per week, extra curricular activities, and an interdisciplinary approach. Learning activities were structured to include real-life problems and situations (McKinnon, Nolan, & Sinclair, 1996).

### **Students' Relationship to Learning**

A third observation is that most students demonstrate greater interest in learning activities that include uses of new technology than they do when participating in traditional approaches to teaching. Many

studies demonstrate that student interest is high when new technologies are available for their use. In a study conducted by The Center for Research, Evaluation, and Training (CREATE), one of the main conclusions noted was that students “are drawn to technology and are intrinsically motivated to use computers.” Computers were always the first choice when students were offered a choice of many classroom activities. Teachers reported that students’ productivity had increased (Guthrie and Richardson, 1995). (Dwyer, 1994) also found the same results in a study he conducted as did a report published by the federal government. This report stated that technology “can be a key vehicle for stimulating learning, primarily because it creates environments and presents content in ways that are more engaging and involve students more directly than do textbooks and more traditional teaching tools” (US Congress, Office of Technology Assessment, 1995).

### **The Effects of Technology on Students’ Attention Span and Concentration**

A fourth observation illustrated by research is that students’ attention span and concentration are greater when using new technologies than when they use traditional resources. A two-year study conducted by Van Dusen & Worthen (1995) confirmed this. These researchers found an increase of twenty percent in time on task

when students used new technologies. Collins stated, "In settings in which computers have been put at the disposal of students as part of some long-term activity or project, researchers have reported dramatic increases in students' engagement" (Collins, 1991).

The relationship of students to knowledge illustrates the way in which students approach knowledge and incorporate it into the information base they have already acquired. When utilizing new technologies, students have far more power than when they use traditional resources. They are stimulated to seek more extensive information on a topic or a more satisfying solution to a problem. In addition, they are able to comprehend a greater number of relationships among pieces of knowledge or data (Bracewell & Laferrière, 1996).

Heidmann, Waldman & Moretti (1996) report:

Multimedia technologies enable the creation of environments in which constructivist learning can take place. They make available to students original materials instead of pre-interpreted and diluted information. They provide tools for the exploration of that data so that students can investigate a topic and approach it with genuine questions. In the process, students create new and examine existing knowledge

structures through the exploration of a topic as well as an appreciation of it. (p.301)

McKinnon, Nolan & Sinclair (1996) in their study concluded that “sustained computer use enabled students to become not just ‘technologically literate’ but it also enabled them to become producers of knowledge as they analyzed data and information and developed testable propositions.” Teaching and learning processes occurred which are not commonly found in traditional classrooms. Students “tended to regard their work as a public activity available for scrutiny and constructive comment by teachers and peers” and they believed that they “need to be actively, and when appropriate, collaboratively involved in the construction, and testing of their own knowledge.”

Cooperation and collaboration are facilitated when students use new technologies in a constructivist setting. Many researchers have highlighted this point in their publications: Newman (1994); Dwyer, Ringstaff, & Sandholtz (1991) in the Apple Classrooms of Tomorrow (ACOT) studies; Dwyer (1994), West (1995); and Lafer & Markert (1994). Other researchers making this claim based on their studies include Brownell & McArthur (1996); McLellan (1994); and Collins (1991).

In one ACOT study, Dwyer discovered that arguments that computers would isolate students from each other were unfounded.

Instead, Dwyer reported increased interaction between and among students. Cooperation prevailed as students participated in a wide variety of learning activities (Dwyer, 1994). Lafer & Markert (1994) found similar results in the assessment of *Lego TC Logo*. The elementary students had to learn how to resolve conflicts and assist each other. The strong desire to solve meaningful problems aided in their learning how to be interdependent and to cooperate. Collins (1991) reported that, because of the infusion of technology into the classroom, schools of the future will be transformed from the current competitive structure of the classroom to a social structure that is cooperative.

Current literature also recommends that students work in pairs for a variety of reasons. First, it lessens the cost of the technology, and second, it facilitates the acquiring of the skills needed for cooperation. In this setting, students will turn to their partner first when needing help. Dwyer (1991) demonstrated that students shift from becoming competitive to collaborating on projects. Because social interaction is needed in mastering certain intellectual skills and performing certain tasks, the pairing of students makes sense (McClellan, 1994).

## **The Effects of New Technologies on Students' Abilities to Practice Inquiry and Collaboration and on Problem-Solving Skills**

How students organize and accomplish their work is important to their success. Students immersed in settings incorporating new technologies increase in their abilities to practice inquiry, collaboration, and problem-solving skills. They become adept at solving technological problems. These are the very skills students will need when entering the work force (Dwyer, 1994). In addition, the use of the Internet by students has been shown to support student inquiry (Soloway & Wallace, 1997, p. 84). Barr (1990) sums it up this way: "If we wish to prepare students for life-long learning, we must begin to introduce them to the tools which they will use in the careers they pursue after their formal education is completed."

Other factors relating to new technologies in classrooms have been investigated. Dwyer et al., (1991) noted that students' self-esteem and motivation in technology-rich environments has been measured and found to be strong. In addition, it was shown that attendance was up and discipline problems were reduced. Students also chose to come in on their own time—lunch, recess, after school—to work on their projects.

Finally, as school reform movements across the United States continue to restructure the way education is defined, many authors discussing reform advocate the infusion of new technologies into classrooms at all levels. They believe that movement toward well-integrated uses of technology as part of overall reform is vital. (Bagley & Hunter, 1992; Capper, 1988; Collins, 1991; Raywid, 1990; Rockman, 1990; and Sheingold, 1991).

When considering the above literature, there appears to be a persuasive case for the successful employment of information technology in a regular classroom applying a constructivist paradigm. Additionally, my own experiences using limited information technology in the classroom led me to believe that use of such technology is a natural fit with constructivist methodology. Therefore, I concluded it would be valuable to study the immersion of a classroom in a setting of ubiquitous information technology. I believe this greatly reflects the world outside the classroom in society at large. The classroom should mirror the society into which students will emerge as young adults.

## Chapter 3: Context for the Inquiry

Hawthorne Elementary School is a modern, brick, open-space building adjacent to Melrose Middle and High School, located in the Hawthorne Magisterial District of a local county in the southwestern region of the Commonwealth of Virginia. The school opened in April 1972 and serves the kindergarten-through-fifth-grade population of the rural Hawthorne community, which lies along a state road approximately five miles south of a small town. Hawthorne Elementary has had five principals since it opened. In the summer of 1991, Barry Miller assumed the principalship.

Hawthorne Elementary houses seventeen graded classrooms. Many formerly open classrooms have added walls. Four mobile units provide classroom space adjacent to the main building. Twenty-two additional specialists and aides support instruction, fifteen of whom are itinerant. All available space is utilized in housing the programs offered by this increase in personnel. Enrollment has risen from 273 in 1988 to 320 today. With the recent construction of several subdivisions, Hawthorne is changing from a rural community to a more suburban area. For this reason, enrollment is expected to continue to rise. Many Hawthorne families have lived in the area for well over one hundred years, often living in older farmhouses. Some newcomers reside in mobile homes on isolated tracts of land while others inhabit large,

modern houses in the newer subdivisions. Currently under construction is a golf course resort that is expected to drastically change the small rural nature of the community.

Many on staff at Hawthorne have worked there for years. In addition to the seventeen classroom teachers, other support personnel include the principal, secretary, special education teachers, speech and language specialist, music, art, and physical education teachers, a guidance counselor, reading specialist, part-time gifted resource teacher, three cross-categorical aides, a writing-to-read aide, three cafeteria aides, a cafeteria manager, three cooks, and two custodians. Most are members of the community, while others commute from outlying areas or towns. All are well known by the Hawthorne community, an active community that exhibits great pride in its schools. The close-knit staff works well together and understands the needs of the children who attend the school. A wholesome climate that is conducive to positive intellectual, personal, social, and physical growth is provided by the school for the students who come from many different backgrounds. The faculty recognizes that the school belongs to the people and is accountable to the community it serves. Parents, school, and community function as a team. In 1997, Hawthorne Elementary School was named a Blue Ribbon School.

## **Samantha Penmon's Classroom**

Samantha Penmon's fifth grade class was carefully selected for participation in the project; in fact, Samantha participated in the overall project design from the outset. Samantha is a teacher I have known and worked with—in many different capacities—throughout the past ten years. At the time of the Field Initiated Study proposal, I was working with her as a resource teacher. Samantha and I collaborated on a project that connected the students in her fifth grade class with another fifth grade class near Seattle, Washington. Using live video teleconferencing software called, CU-SeeMe, students exchanged geographical information in real time. It was at this juncture that I approached Samantha about the possibility of her participating in the Field Initiated Study. When she readily agreed, I discussed the project with Barry Miller, principal of Hawthorne. He, too, gave full support to the seeking of funding.

For the past few years her fifth grade class size has been about twenty students. Housed in a school practicing full inclusion of all students, Samantha's self-contained classroom includes special education, regular education, and gifted learners. Students remain in the classroom for most of the day. The exceptions include grade-level regrouping for math, as well as regularly scheduled visits to specialists such as music, art, and physical education. Students with special

needs are served within the classroom as resource assistance comes to the students rather than the reverse.

Samantha was my first choice for many reasons. A collaborative relationship between the two of us was already in place. In addition, I had long admired her approach to teaching and interacting with children. Her teaching style was warm and inviting; it was my observation that students thrived in her classroom.

A lesser factor affecting the selection of Samantha's classroom was that Hawthorne Elementary School already had a T1 connection providing high-speed access—approximately one hundred times faster than a high-speed modem—to the Internet, one of four schools in the county at that time. Hawthorne was the only elementary school to have this high-speed connectivity in the attendance strand to which I was assigned. Samantha Penmon was a natural choice in this setting because of her eagerness to learn more about using the computer and Internet resources as tools for teaching. Further, she was interested in extending her knowledge of a constructivism paradigm and how to put theory into practice.

### **Instructional Design**

The FIS project stated that the classroom instruction would integrate subjects and utilize a constructivist approach. In previous years the fifth grades at Hawthorne had used a model called

departmentalization wherein each teacher specialized in one subject and students rotated from teacher to teacher during the day. Because of the FIS project, the teachers agreed to modify the structure of the day. It was modified into an "integrated day" approach. Students would remain with Mrs. Penmon all day with the exception of mathematics and specialties such as art and music. For math they would be regrouped by ability and assigned to one of the three fifth grade teachers. For the bulk of the day, a cross-curricular approach would be used. Thus, as students became interested in a particular topic such as the Iditarod, language arts, social studies, and science objectives would be taught under this umbrella with much student-directed activity.

Many discussions were held to finalize the design of the classroom instructional program. I regularly reminded Samantha that she was the final arbiter; that it was her classroom, not mine. I would offer suggestions, but she was in no way obligated to follow my recommendations. Her reply was always that she needed help in understanding how a constructivist classroom would operate as well as how to infuse the technology into the instructional program so that it was truly a tool and not a dominating force. She was willing to trust my judgment in establishing the parameters for creating the large overview of the instructional design, but chose to retain her authority

over the day-to-day decisions concerning lesson plans and details as to how the classroom would function. We concurred that I would adapt to meet her style and classroom needs. All she needed to do was to keep me apprised of her level of comfort and satisfaction.

## **Project Decisions**

### **Hardware**

The following Gateway configuration was selected for student use in both the classroom and at home:

- 100 MHz Pentium;
- 256 Kbytes cache;
- 16 Mbytes main memory;
- 33.6 Kbaud internal communications modem;
- 8x CD-ROM drive;
- 1.2 Gbyte disk drive;
- 1 Mbyte video card for 1024 x 768 resolution, 256 colors;
- 15" monitor;
- Sound Blaster 16 bit sound card and speakers; and
- Hewlett Packard DeskJet 680C inkjet or equivalent printer.

Other hardware to be placed in the classroom included a Polaroid 110, 500 lumens LCD projector for projecting from the teacher's machine to a large screen; an HP LaserJet 5M network printer to allow student and teacher work to be printed in a high-quality format; an HP

Scanjet 4C scanner to allow the students and teachers to scan and import graphical images; and a Kodak DC-50 digital camera that would allow the taking of photographs in digital format to be imported into documents, multi-media presentations, or pages.

### **Software and Restricting Access to Inappropriate Internet Sites**

The software package designed for the student machines was as follows:

- *Windows 95* Operating System;
- *Cyber Patrol* (site blocking);
- *Dunce* (dial-up utility);
- *Internet Chameleon 5* (networking suite);
- *Internet Explorer* and *Netmeeting* (networking tools);
- *Mcafee Virus Scan* (virus protection);
- *Painsthop Pro 4.1* (imaging);
- *PFE* (text editor);
- Microsoft *Office*, a software suite that includes *Word*, *Excel*, *Access* and *PowerPoint*, tools for word processing, creating spread sheets, data bases, and multi-media presentations;
- Microsoft *Bookshelf*, a suite of reference works including a dictionary, encyclopedia, historical time line, atlas, and biographical dictionary; and
- *PowerToys* (Win '95 utilities).

One concern that had to be addressed was how to deal with Internet sites inappropriate for students. Blocking software to keep students from having the ability to find these sites was selected.

### **Internet Provider**

At the time of the study, the local community-networking project that had been providing access through the university modem pool was no longer available. E-mail accounts were still provided by the local community network project, but it was up to customers to select and subscribe to their own Internet provider. After investigating local options, *Citizens*, Internet provider of a neighboring community, was chosen. *Citizens* agreed to a \$20 per month subscription charge to each Hawthorne fifth grader, a charge paid for by the project.

### **Telephone Service**

Telephone service was provided for the two families that needed it. Bills were sent directly to the school in the principal's name.

### **Furniture, Carpet, and Storage**

The classroom was housed in a mobile unit, 25' x 35.' This is not a large space for twenty-four students, a teacher, and a lot of hardware. Samantha, the classroom teacher, and Janet McKnight, the technology aide, selected the furniture and the room arrangement. They read journal articles delineating appropriate classroom design when

computers are installed and considered many factors when making their decision:

- All students would be able to view both the blackboard and the projection screen from their seats;
- There was no way to prevent the computers from being prominent, but furniture of the same color as the hardware was selected to lessen the dominance;
- Students would need to be able to move from place to place with ease;
- A group space in front of the board was needed;
- Each work station would be shared by two students;

The decision was made to order 30" x 72" gray tables, with a shelf unit underneath for CPU, a tray for wiring, and a center drawer for pencils. The table was large enough to provide students with workspace for writing and placement of the computer between the pair. Each student had his or her own keyboard that slid out from under the table. A box with a switch allowed each pair of students to select "Student A" or "Student B" when using the hardware. Storage space for students' books and supplies was provided under the tables. Gray carpet covered the floor.

## **Design and Wiring of the Classroom**

The classroom was wired from underneath the mobile unit with outlet boxes situated under the back of the tables, out of the way. Samantha and Janet used graph paper and moveable cutouts of furniture to design the layout of the room. They determined the arrangement that would best allow students freedom of movement, ability to see the board and screen, and space for the entire group to meet away from the tables. A photograph of the classroom appears below in Figure 1.



**Figure 1: Samantha Penmon's classroom**

## **Ethics and Security**

Security and ethics are intertwined. Both cause concerns. Two ethical issues were addressed—how to deal with Internet sites inappropriate for student use and how to control computer viruses students could accidentally introduce into their machines. In both cases, appropriate software provided partial solutions. These two concerns were directed at preventing outsiders from negatively impacting the students and their work. An equally important issue was how to teach the fifth graders that they, too, have ethical responsibilities. It was decided that lessons on computer ethics would be part of the curriculum.

It was a given that all adults having access to the classroom must maintain high ethical standards. As an example, all software used in the classroom would be licensed.

## **Lottery for Selection of Students**

The Department of Education required the school division to submit a statement of assurance delineating that all fifth grade students at Hawthorne Elementary School would have an equal chance to participate in the federally funded Field Initiated Study. No student could be excluded based on gender, race, ethnicity, or handicapping condition. In order to select students fairly for inclusion in Ms.

Penmon's fifth grade class, a lottery was held with all fifth grader students having equal chance of participation in the project.

## Chapter 4: Methodology and Materials

In this chapter I describe the materials and methodology used to conduct this study. First I describe the essence of a descriptive case study. Then I detail the data gathering and data analysis techniques I used followed by a short discussion of methods employed to validate and verify my findings. I also explain major problems or questions that had to be considered. A description of the specifics of the methodology used is also given.

### **Descriptive Case Study**

According to Merriam (1988), a descriptive case study presents a detailed account of a phenomenon under study, an account that is not guided by generalizations that are either hypothesized or established. It is a form of qualitative research with a wide focus; that is, much evidence is gathered by a variety of means and from many sources and finally, carefully analyzed. The case study is viewed as a useful method for presenting information about areas of education in which little research has been conducted. One precondition for a case study is the uniqueness of the situation being studied must be established because a case study might provide a database for further research. The case study as a form of research is more concerned with describing processes than behavioral outcomes. When information gleaned is not subject to truth or falsity but can be subject to scrutiny

on the grounds of credibility, a case study is warranted. The aim of a case study is to eliminate erroneous conclusions so that the reader is left with the best possible interpretation of what occurred.

The descriptive case study I conducted follows Merriam's criteria. I chose to elaborate the overall study with four stories of individual children. The rationale for this decision was that I wanted to give the reader the "full flavor" of the program with several illustrative examples.

Each student story is written in narrative style with pseudonyms used to obscure the names of real people and places. Evidence that was gathered by a variety of means has been utilized throughout each case study to tell the story of a unique classroom, one replete with state-of-the-art-technology, and the effects of this milieu on the learning of four children.

### **Gathering Data**

In this study I functioned as a participant-observer during the year I collected data. At times I became part of the classroom as I model taught lessons for the classroom teacher. At other times I was a silent observer, taking field notes, transcribing exactly what I saw.

Samantha, the classroom teacher, approved methods I used to collect data. These included field notes—observations scripted without editorial comment and then dated, as well as dated journal entries that

interpreted the field notes contained in my observation journal. Interviews with the teacher, parents and students were conducted with their permission. Each student was interviewed once at school and one of the students (Mike) was interviewed an additional time at his home. Mike's mother was also interviewed during the home visit. The other students were not interviewed at home because their parents did not respond to my requests to visit the home. Videotapes of the classroom, e-mail exchanges among all parties, dated notes of all meetings, and other artifacts from the classroom such as samples of student work also were collected. Informal conversations that occurred as I worked with the class were written in a second observation journal before I left the building so that the gist of all verbal exchanges could be documented. Quotes from this journal are a faithful approximation of what a person said. Notes taken during discussions Samantha and I had were kept as well as any later interpretations. Finally, my personal journal was used to document my questions, concerns, or frustrations with the process, as well outlines of plans and successes.

Because of the quantity collected, all data could not be included in the final narrative. As an example, I collected several hundred pieces of e-mail exchanged between the students and me. As appropriate, I selected examples that illustrated a particular point. It was difficult at times to choose only one example because so many

seemed relevant. In those cases, I selected examples authored by one or more of the four students I followed most closely. Other data were easier to make decisions about. During my year of study, I gathered information comprehensively because I was unsure of the focus on my final report. Once I decided to tell the story of what happened in the classroom, it became easier to determine which of the data could be excluded. In no case was any data omitted to avoid negative findings.

### **Data Analysis**

The goal of data analysis is to make sense out of one's data and generally takes thrice the time as data collection. The process of analysis can include the consolidation, the reduction, and, to a great extent, an interpretation of the data because data do not speak for themselves. The amount of interpretation one strives for is dependent upon the purpose of the study as well as the type of end product desired. Analysis of the data can take place while it is being collected, but analysis becomes more intensive once all the data are complete. The researcher then examines in-depth the data looking for emergent themes or conceptual categories using both convergent and divergent thinking (Merriam, 1988).

As I collected data, I did make cursory interpretations, which I noted in my researcher's journal. However, a year later, looking upon all the data holistically caused me to view things somewhat differently.

I found I was able to draw new conclusions as well as see both the big picture and individual pieces. It was not until I finished writing the initial narrative that all the themes delineated in the conclusions emerged.

### **Validation and Verification**

Validity and reliability are critical considerations when data are interpreted. Merriam (1988) states that validity increases if repeated observations are made in the same study. Repeated and long-term observations can be made. Triangulation involves the researcher using multiple sources to confirm emerging findings. The researcher customarily takes the data and his or her interpretations back to the people from whom they were derived. Peer examination is also used. As mentioned earlier, it is incumbent upon the researcher to clarify his or her predilections or assumptions. Because there can be many interpretations for what is happening, there is no benchmark by which one can take repeated measures and establish reliability in the traditional sense. Human behavior is never static, but the researcher can predict whether or not a replication of the study would have similar results. In all cases, the goal of the researcher is to interpret findings in such a way that the findings are dependable and consistent (Merriam, 1988).

In my study, validation and verification occur in two ways. First, there is triangulation among all the varied kinds of data collected. E-mail exchanges support what was happening in the classroom as do the interviews and journal entries. Student achievements in use of the technology are illustrated through e-mail exchanges, journal entries, and the many products the students created. Interviews with the students and the one parent also corroborate the findings. Transcribed comments made by parents in group meetings bear out the findings presented herein. Second, Samantha Penmon agreed to read the narrative and to provide feedback if needed.

### **Major Problems or Questions**

There are major conceptual and methodological research design and measurement issues that I have identified related to this study. First and foremost is the issue of maintaining the confidentiality of any participants interviewed in the study as well as acting ethically and judiciously in selecting and reporting findings. My bias as a participant-observer is carefully identified, and any biases that cannot be controlled are reported. It is important that I have carefully distinguished between data and my interpretations of the data. Multiple methods of collecting data facilitated the triangulation necessary to ensure reliability.

As noted earlier, the names of all participants have been altered, as have the names of schools and locations. In addition, I have omitted any project Web page addresses in order to maintain the anonymity of the participants. This was a difficult decision because the Web pages are a rich collection of data that illustrate many of the conclusions drawn.

Remaining neutral was difficult because, from the outset, positive events were occurring. However, I have made a concerted effort to writing a balanced report of all in which I participated and observed. I also carefully considered many times all data used rather than relying on any initial interpretations I made in my researcher's journal. In addition, I have not omitted any negative findings.

### **Project Planning**

This project took place in 1996 and 1997. Weekly planning sessions were held throughout the term of the project. At our first meeting Samantha gave me a sheet of paper with categories of at-risk students and lists of fifth graders' names. Highlighted were the names of students in her class. Three girls, Sheila, Susan, and Missy, and one boy, Mike, were labeled "at risk" in writing, based on the state predictor test administered in fourth grade. The state reading test, also administered in fourth grade, identified as at risk four of Samantha's girls, Karen, Mandy, Erin, and Emily, and five of her boys, Ben, Mike,

Marc, Brian, and Joe. In addition, several students were labeled at-risk in math based on the Iowa Test of Basic Skills scores from fourth grade. These students were Karen, Mike, Marc, Candy, Brian, Joe. I quickly noticed that one student—I later learned it was Mike, a student I was following—was categorized as at risk in every area—writing, reading, and math. I also noted that of the eleven fifth grade students at risk in writing, only three were Samantha's, while exactly one third of the at-risk fifth grade readers were assigned to her. Seven of eighteen at-risk fifth grade math students were included on her roster.

Samantha also provided me with information about individual students.

- No phone in home—Ben and Lizy
- Gifted—Naomi and Chris
- Special education—Eric (Other Health Impaired/attention deficit hyperactive disorder) and Erin (other health impaired/ attention deficit hyperactive disorder). Previously, Eric was labeled emotionally disturbed. Karen was formerly identified learning disabled, but no longer qualified for services.
- Missy—new to school, low socioeconomic status, lives in trailer with mother and her boyfriend in “rough” neighborhood

- Sheila was home schooled previous to this year. She appears to having some problems adjusting to the social environment of school.
- Jackie and Janet came to Hawthorne Elementary last year.
- Candy and Mandy are twins.
- Billy is very shy. He cries when asked to read aloud though he is capable of doing so.

Next discussed was the definition of my role. Samantha inquired as to what kind of data I would be seeking. I explained that my interest was in watching the year unfold. I was interested in discovering whether or not a teacher could effectively manage and integrate the technology using a constructivist paradigm

### **Selection of the Students for In-depth Study**

There were twenty-four students in the classroom. Because it would be impossible to study all of them, Samantha and I decided that I would focus on four students in depth. For gender balance, I deliberately selected two boys and two girls. Exactly which two boys and which two girls for the study would be determined after I interacted with the students the first time. I wanted to observe the classroom before making my selections. All would be kept confidential, and pseudonyms would maintain anonymity.

## **Rationale for Early Selection of Students**

I chose students to study early in the year before I knew any of them. Beginning this way I was able to focus on specific students early to ensure that useable data did not get away. It was my goal to begin the study at the same time the technology was introduced into the classroom so that I could track each student's progress from the onset. I planned to watch the students carefully and interact with them as much as possible on my first visit to the class so that I could make my preliminary choices. I did that and selected four students to study after spending a morning with the class. This was prior to the introduction of the technology. I had no other information about the students at that time, only my initial observations to guide my choices.

## **At Risk Students**

It is important to note that I do not recall—out of context—the names of students I do not know. Thus, even though Samantha had shared with me the names and information relating to students labeled “at risk,” I did not remember who they were because I do not retain names without faces. In fact, the first time I met the students, I had completely forgotten that any information about specific students had been shared with me. It was not until I reread my early notes well into the project that I discovered I had the data.

## **Rationale for Selection of Specific Students**

Prior to meeting any of the students, I decided to try to select ones who are often overlooked or not obvious choices. I wanted to include students who are not always the most successful in school. Students who appeared to be “teacher pleasers” or seemed exceptionally bright were not ones I wanted to select. Instead, I was more concerned with finding students who were, perhaps, struggling or who did not find school to be interesting. In all cases my rationale for selection related to discovering how students would react to a very different learning environment, one in which they would be given much choice and would have opportunities for taking ownership of their own learning. The first day I met with the students I had already decided to try to make my choices after I had worked with the class for the morning. I would observe individuals closely so that I could determine which four students would become the candidates for closer study.

### **Mike**

The first student I selected was Mike. I first noticed Mike when I observed the classroom for the first time. He was inattentive as I introduced myself to the class. The students were seated on the carpet around my chair, and, were well focused. The exception was Mike who wiggled continuously, edging his way to the perimeter of the group. Eventually he crawled under one of the tables and sat there engrossed

in playing with his mechanical pencil. As I finished, I observed Mike. He was unaware that I had ceased speaking, so great was his concentration. Not until another boy pulled out a chair to sit down, did Mike realize that the class was dispersing to return to their seats.

The students were dismissed to go outside to play. I followed to talk with Samantha as she stood duty watching them. I asked about the boy who crawled under the desks. Mike, she told me, stayed tuned out much of the time and did little work. He complained loudly about hating school, except for outside play. It was at that moment I made the decision to study Mike. It would be important to find out if an altered learning environment would impact a student who appeared disinterested in school.

I told Samantha I was interested in finding out how Mike would perform in school that year. She related that, based on standardized test scores from fourth grade, Mike had entered fifth grade labeled “at risk” in three areas—reading, writing, and mathematics.

### **Missy**

Missy was a tall, quiet girl with large brown eyes whom I noticed because she was so much larger and more physically mature than the rest of the class. I wondered if she was older and whether or not she had ever been retained. Attentive, she seemed puzzled at times by what was said in class. My first interaction with her was when she

asked a question that struck me as a bit unusual. I couldn't figure out how she came up with the question because it seemed disconnected to the topic at hand. My probing didn't enable me to follow her line of thinking. When I asked Samantha about her on the playground later that morning, I learned that Missy, new to Hawthorne, was a low functioning student, but one who put forth extraordinary and serious effort. I chose Missy as the next student for a case study.

### **Joe**

My third choice was a boy named Joe. He was silent and still most of the time and appeared timid and shy. I noticed that he always watched other students for a few seconds before he joined in the activity even if it was merely to change locations from desks to the rug. He hung back surveying the situation before slowly shuffling to join the group. Joe never engaged with me as other students did. Rather, he was content, it appeared, to melt into the background. Joe did not interact with other students in class and was hesitant to answer questions if called upon. Never did I see him volunteer to answer a question or to speak aloud. Joe seemed totally uncomfortable inside his own skin. I stopped by his desk and spoke to him. He avoided eye contact and looked uneasy as he haltingly spoke to me. At first I thought he was a stutterer, but I was mistaken. I came to realize that Joe's intense shyness and lack of confidence made it difficult for him to

interact with strangers. At that time I was still an outsider and Joe was not ready to form a relationship with me.

### **Lizy**

I was drawn to Lizy because her nametag appeared to be misspelled as it did not follow the conventions of phonics. I was concerned that a fifth grader would be unable to spell correctly her own name. I wondered if the "mistake" was one of haste. My first interaction with her was pleasant and positive. I spoke to her as I was circulating around the room observing individual students. Lizy allowed me to read what she was writing; it was poorly written with handwriting that did not seem age appropriate, but rather appeared to be the poorly coordinated cursive of a much younger child. Her spelling did not seem to follow any prescribed rules of English. I asked Lizy how to pronounce her name. She looked at me with a puzzled expression as if to indicate that surely I could read, and then she patiently shared what to her must have seemed obvious. Her name is pronounced to rhyme with tizzy. Lizy's Appalachian dialect caught my ear. There was something about her that struck a chord with me; she seemed so alive and eager. She appeared to be a child that was confident and tenacious though possibly functioning at a below average level. I made the decision to have her be the second girl in my group.

When I asked Samantha about her later, she stated that Lizy lived with her young mother and was an only child. Lizy was cooperative and dedicated but often needed more time to catch on to things. Her skills of written language were below grade level.

### **Interactions with Students**

During the year of study, I interacted with the students in many different ways. At times I was the teacher of the class and collaborated with them in a teacher-student relationship. At other times I visited the class as an observer, chatting informally with the students before class began. Sometimes I served as an aide to the teacher and circulated throughout the class, offering help to individual students. On occasion I ate lunch with the class or joined them on the playground at recess, talking with students as they chose to converse with me. Much e-mail was exchanged between the students and me. At times the e-mail was a homework requirement, while at other times it was voluntary. In many instances, the e-mail was purely for the purpose of social interaction. Students also used e-mail to ask me for assistance or for submitting homework. Interviews were conducted at school and one at a child's home. Students remained after school on specific days for lessons pertaining to use of the technology. I attended those classes a few times. On rare occasions, I would encounter a student in public where we would greet each other and chat. I kept careful notes

of all encounters and exchanges. When informal conversations occurred that were not scripted, I wrote the gist of what was said as soon after the exchange as was feasible.

## **Themes**

In order to determine the themes that became the foci of this report, I perused the data multiple times. These included student products, e-mail, journal entries, interviews, videotapes, field notes and observations. As a theme emerged, I jotted it down for later consideration. After I compiled a list of half a dozen dominant themes, I gave each careful consideration. I next constructed a matrix delineating the themes and the number of times each theme was supported by the data. I did this by assigning each theme a color and then highlighting evidence in the data that supported that theme. In the end I chose to focus on the three themes that were of greatest personal interest to me that were also heavily supported by the data.

The three themes emerged from the data collected in this study. A careful analysis indicated that three key facets coalesced, overlapping and intertwining, yet remaining distinct. The themes spanned the global data and I wanted to discover if they applied to data about specific students as well. The case studies clearly illustrate that they do.

## **Social Interaction Is Impacted by Technology**

The first theme relates directly to the theoretical underpinning of Vygotsky's work, i.e. social interaction as a structural component of constructivism. This theme emerged vividly from the e-mail exchanged between the students and me.

### **Collaboration**

Tangentially related and an extension of the social interaction exhibited was the increase in collaboration between and among students. This, too, was evident throughout the e-mail exchanges, but I also observed collaboration directly while in the classroom.

### **Self-Directed Learning**

Finally, the previous two themes are components of the third: self-directed learning. The students in this study all chose to utilize the available technology for the purposes stated above—social interaction, collaboration, and self-directed learning. In addition, the constructivist organization of the classroom enhanced the students' opportunities to interact socially, to collaborate, and to seize control of their own learning.

Each theme will be described separately using the four student stories that follow as illustrations. For each student, a chronological approach will be used to illustrate the progress the student made as the year unfolded. While there is much overlap between and among

themes, each will be considered individually. It is important to note that the order of the themes within each child's story differs from how they were presented above.

## Chapter 5: Individual Student Stories

### **Structure of the Student Stories**

Each of the four stories considers one child in depth and explores each of the three themes—self-directed learning, collaboration, and the effects of technology on social interaction. Where appropriate, data have been included to illustrate the theme under consideration. Effort has been made to give the reader the “full flavor” of each child so that the child’s personality emerges. I did not want to lose the essence of the child, as each child’s individuality and behavioral characteristics are important to the analysis of the themes.

It is important to remember that the students had in their home the same technology that was available in the classroom. At the end of the three-year project, the students will retain ownership of the home computer and its peripherals. As they move to sixth grade, the classrooms will have little if any technology in them, though a computer lab can be utilized if teachers choose to allow their classes to avail themselves of it. The students will have available for home use the technology they acquired in the fifth grade at the outset of the project.

## **Student Stories**

### **Mike**

#### **Self-Directed Learning**

Mike entered fifth grade labeled “at risk” in three areas—reading, writing, and mathematics. In addition, his teacher reported that Mike stayed tuned out much of the time and did as little work as possible. He complained loudly about hating school, except for outside play. The first time I observed the class, Mike stood out as a student who did not stay focused or engaged in the task at hand. Instead, he fidgeted, played with a mechanical pencil, and crawled around under desks. Mike was so tuned out that when the rest of the class was dismissed from sitting on the rug to return to their desks, he did not notice until another student pulled a chair from the desk under which he was perched. To me Mike expressed a preference for “all-day” recess (Observation Journal, October 30, 1996). Mike’s mother reported that the previous year Mike showed little interest in school or completing homework preferring, instead, to watch television. (Interview, February 6, 1997) His fourth grade teacher stated that Mike was happiest when he was outside playing, that he was rather “apathetic” in the classroom but was not a behavior problem (Interview, June 8, 1997).

The morning after the technology had been installed in the classroom, I observed the students as they worked. They had arrived that Monday morning not knowing that the hardware was put in place over the weekend. I came into the room thirty minutes after school had begun. The children were buzzing with excitement as they tried to play solitaire in order to learn mouse movements. I decided to observe the entire class but to focus particularly on Mike. He had little previous computer experience according to Samantha and no computer at home. I watched as Mike continued to try different strategies on his own rather than ask for help at the first bump in the road. I noted, too, that a majority of the students sought help immediately when having difficulty. All students were actively engaged for the hour I observed. No one lost interest or focus, not even Mike. At the end of my hour-long visit he was still as engaged as when I had first arrived. I also observed that he was deft at using the mouse and was one of the students who took initiative in trying new things. Mike explored the desktop in addition to playing Solitaire (Observation Journal, October 23, 1996).

A week later I returned and again observed the students while they worked. Mid-morning Samantha shared with me an incident that had occurred earlier in the week:

You know the most amazing thing happened. We were talking about pioneers the other day and we read a

woman's journal from that time period, the 1840s. The journal was included in one of the books in our new reading series. That night Mike went home and began surfing the web. He located the Santa Fe Trail Web pages, and there on one of the pages was biographical information about this same woman whose journal we had read. He was so excited when he brought it in to show me. I couldn't believe it! Since then, the class and I have been using the Santa Fe Web pages to learn more about the westward movement. By the way, have you noticed the little spiral pad Mike keeps in his back pocket? On it are the URLs of all his favorite Web pages. (Observation Journal, October 30, 1996).

Samantha's comments indicated that Mike was actively using the computer at home and that he was exploring on his own. Samantha commented that the ownership Mike was taking of his learning and his willingness to, without prompting, bring information he had found to class could possibly change his attitude toward school and learning. Samantha went on to explain that she had already noticed a significant change in his demeanor and behavior. He had quickly mastered using the mouse and was the best in the class at locating sites when the URLs were posted on the board. In addition, Mike assumed the role of facilitator and was eager to assist others. Samantha stated that the rest of the class was beginning to view Mike in a new way. They no longer dismissed him as an irritant bent on distracting others and doing everything possible to get attention or to avoid attending to his work as he had in the past (Observation Journal, October 30, 1996).

In December, Samantha talked about Mike and the differences in behavior she had observed in the five weeks since the technology was installed in the classroom and in the homes of the children. She spoke of changes she saw in Mike's participation in school and his attitude toward learning:

Mike last year was one of those kids for whom school was, at best, so-so, and now he has really tuned into figuring things out. He's really trying. He's probably one of the children that you knew he had something that you could tap into, but you just couldn't click it. But now he's become excited about things. Recently I was thinking of his academic life. He was just a kid turned off by school. Until now I hadn't really thought about other kids and how they now respond to him. But they do seek him out most often. He knows all the sports addresses for Web pages. He has that little notebook that he carries and he brings it in with addresses for them. These are addresses he has found on his own at home. (Interview, December, 1996)

The students were first introduced to using a browser as well as reference software, *Book Shelf*, to locate information. The browser allowed students to access Web pages on the Internet and *Book Shelf* provided electronic versions of standard reference works—a dictionary, thesaurus, and encyclopedia. They also began to use Microsoft *Word* for word processing and creating tables. In December students were beginning to use e-mail, and by January, students were using it regularly. They used it to communicate with each other and with their teachers. Some use was required; most was voluntary. Required use included e-mailing homework to the teacher who had assigned it. On

one visit I gave the class an assignment to complete that night with directions to e-mail their work to me. Each student was to develop a set of three clues about a state, and I was to use the Web page we had agreed upon to discover which state the clues referred to. Mike was one of the first to e-mail his homework. He chose to send three sets of clues, all of which were exceptionally well done. Every word in his clues was spelled correctly and punctuation was appropriate. This seemed to indicate Mike, who was not an adept speller, was using the spell check feature on his computer. I later learned by talking to Mike that this was, indeed, the case (Observation Journal, January 6, 1997).

School resumed after winter break, and again, homework was assigned to be e-mailed to me. Following in Figure 2 is Mike's homework, an explanation of a science demonstration I had conducted that day. It is in the exact format in which he e-mailed it.

**Mike.....1-22-97**

**Ms.Matusevich's Experiment** Today Ms.Matusevich did a experiment with the whole class. The experiment was about science. What I saw was Ms.Matusevich put sugar in a test-tube. Now Ms.Matusevich lit a alcohol burner with a match. Then Ms.Matusevich put the test-tube over the alcohol burner and it burned the sugar and it started to bubble. Ms.Matusevich told us to watch the steam I watch the steam raised into the air and I have never ever seen that happen before but when my mom cooks. If you do not know what a alcohol burner is it is like a perfume bottle but it has a wick and the burner burns the wick. Then Ms.Matusevich passed the chemistry glass that she put in the sugar in and it smelled like marshmallows getting roasted by a camp fire. When the sugar burned the sugar the first thing it did was it turned brownish-blackish then it was solid black. Then it became a big solid.

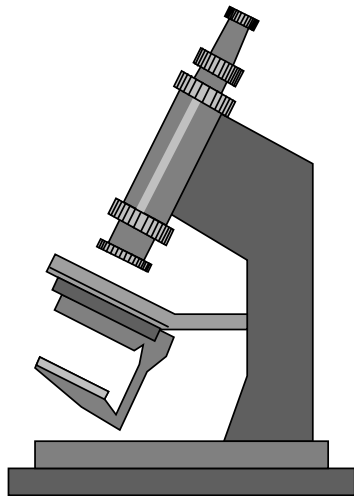
**Sugar is composed of three kinds of atoms: Hydrogen,  
Oxygen, & Carbon.**

**This was a science experiment and IT WAS WAY  
COOL!!!!!!**

**Figure 2: Mike's explanation of the science demonstration**

Along with Mike's explanation was a second e-mail message  
(Figure 3) with an attachment:

---



Your Still a good chemistry teacher. **Your**  
**the best Mrs.Matusevich!!!!!!!**

**Figure 3: E-mail attachment from Mike**

The above example illustrates Mike's facility with importing graphics and changing font size as well as using the highlighter. When I showed it to Samantha, she indicated these were skills Mike had been taught in class but was choosing to use on his own (Research Journal, January 23, 1997).

Informal conversations with Mike told me that he continued to make discoveries on his own at home. He explained how he had figured out how to use various pieces of software that had been loaded on the students' machines. He chose to send e-mail to me with recorded messages in "WAV" (sound) files. After receiving the e-mail, I would open the files and hear his voice instead of merely reading his words. Once I received from Mike by e-mail a media clip containing full motion video (Observation Journal, January 13, 1997).

I gained permission from Mike's mother to visit the home to interview both her and Mike. A February day found me at Mike's trailer, late in the afternoon. Situated on land on which his mother was reared, the many acres abutted the school property. Mike's mother greeted me and introduced me to all the family pets. Several cats and dogs were about, all of them friendly. She invited me in and showed me where the computer was kept. The family had rearranged the kitchen to house the hardware in a place where all could easily access it. They now ate in the living room on small tables because the

computer took up space formerly used for eating (Observation Journal, February 6, 1997).

Mike's mother told me that the previous year Mike had never talked about school. "This year he talks about it all the time," she said. "Like last night. He couldn't wait to do the science experiment given for homework. He loved doing it. Last year he was never interested in homework." When asked if Mike ever chose to use the computer at home she responded, "Oh, my, yes. He sits there every night looking for things he's interested in. His sister or I are always going in the kitchen to see what he's found. We just love it. Mike's real patient. He taught me how to use it—the mouse and all. Boy, he's quick. Last year we'd all sit in front of the TV until it was time to go to bed. Now we're all learning from the Web instead." (Interview, February 6, 1997)

When interviewed, Mike stated—without prompting, "You know what? I'm a lot smarter now, and I can read better, too. You know how I know? Last year I'd always watch TV at night. Now I'm sitting surfing the Web. On the Web you have to read everything. The more you read, the smarter you get, and the more you read the better you can read." (Interview, February 6, 1997)

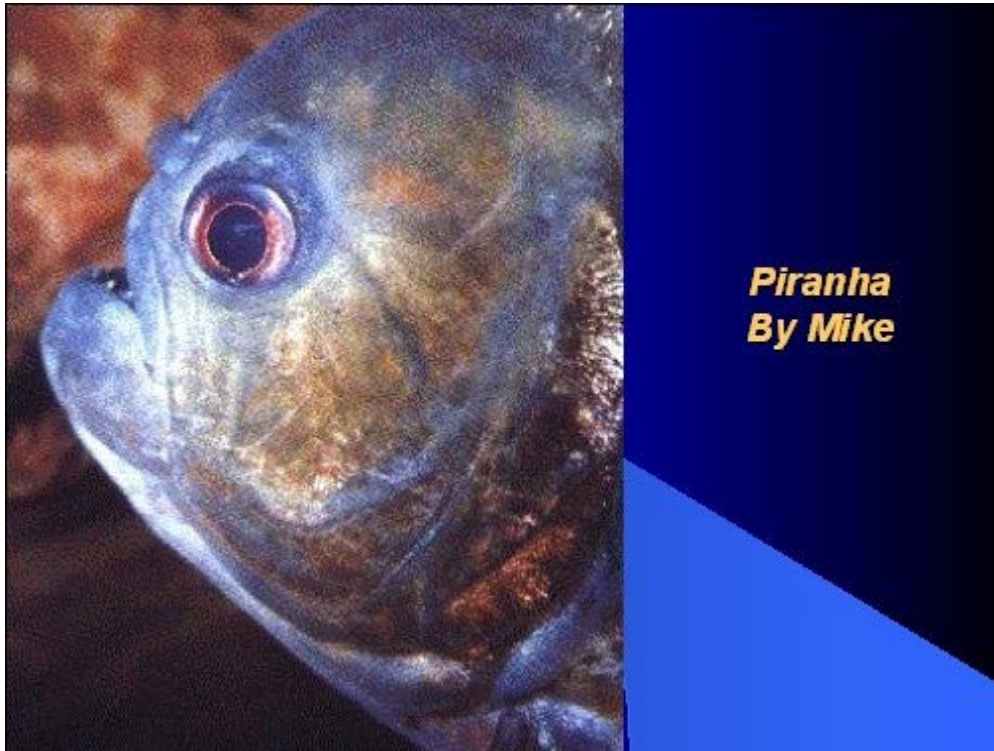
A winter snow arrived, but Mike continued to learn on his own. School was closed for several days. Mike got bored during snow days. On several occasions he sent e-mail to the class listserv asking if

“anyone is out there” imploring someone to communicate with him. Finally, he asked Janet, the technology aide, to find something for him to do. Janet recorded her voice in a WAV file and then reversed it so that her speech was backward. She sent it to Mike who quickly downloaded the appropriate software and figured out how to hear the message. He e-mailed Janet’s exact words—in text format—to her within a short time. Then, he used e-mail to teach interested class members what he had learned.

During one of our meetings, Samantha told me that Mike had noticed Miss Turner, the student teacher, using PowerPoint presentation software. He had found it on his machine and had begun to fiddle with it, eager to learn how to use it. Mike’s enthusiasm was infectious; soon other students wanted to learn as well. Because of this—student interest and motivation—learning PowerPoint became the next goal for using the available technology as a tool. It was decided that the students’ culminating projects for the study of oceanography would be in PowerPoint mode.

Mike’s first PowerPoint presentation (Figure 4) was focused more on the “bells and whistles” of the software rather than on the content of his report. It appeared that he spent more time utilizing the software features available to him than on the textual information he

was presenting. Samantha was pleased, however, with his investigation.



**Figure 4: Mike's PowerPoint presentation (External link;  
Microsoft *PowerPoint* file; 635 KB)**

Toward the end of the school year, Mike's mother met with Samantha and told her how she and Mike shared an interest in the Civil War. She related that the family was having a good time using the Internet to learn more about the topic. She reported that one evening the family had got so involved learning about the Civil War that when they finished, they were shocked to find out that two hours had passed. "Before we got the computer," Mike's mother said, "we'd have

just been sitting there watching TV.” (Observation Journal, May 1, 1997)

Mike’s insightful comments about himself as a learner vividly highlight how self-directed he had become. He was aware that his reading skills were improving. Mike also noted that reading Web pages caused him to learn more, particularly because he was no longer spending many hours in the evening watching television. Mike’s efforts to seek out, on his own, information relating to topics studied in class again illustrate his efforts at taking charge of his own learning. He went a step further, however, by bringing to class and sharing what he had learned, facilitating others’ learning as well as his own. Mike, then, became a catalyst for many other students in their own efforts to be self-directed learners.

Mike became quite skilled at using various aspects of the many different software packages loaded on the students’ machines. He surfed the Web effortlessly, used e-mail on a regular basis, transferred files between school and home, accessed *Book Shelf*—a reference tool—as well as Paint Shop Pro and scanning software. When word processing, Mike utilized the standard features of a word processor such as changing font type and size. He also created tables, checked his spelling and grammar, and imported graphics and color. Through his extensive exploring, Mike became adept at using PowerPoint

including importing sound effects, full motion video, and animation. Mike mastered all of these skills partly because he became so self-directed and explored extensively on his own.

### **Collaboration**

My early observations of Mike showed that he was well liked by boys in particular when he was outside on the playground in self-directed play. In the classroom, however, it appeared that Mike was not disliked, but more or less tolerated. He didn't contribute much in class and could be a distracting influence keeping others from participating (Observation Journal, October 17, 1997).

The first morning the students used the computers, Mike and his partner took turns using the equipment, though Mike dominated as his partner seemed content to observe Mike as he deftly maneuvered the mouse. Mike was willing to assist his partner when asked to do so. A week later, when the students were perusing an online newspaper, Mike showed another student, Emily, how to find a plane crash highlighted in *USA Today*. After assisting his classmate, he went back to his seat and began reading about the Tech football team (Observation Journal, October 23 and October 30, 1996).

On my next visit the following week, I noted a change in behavior from Mike as I taught a lesson. He was facile at finding the Electoral College home page before any of the others and was out of

his seat like a shot when Samantha asked him to help Karen and her partner who were unsuccessful in getting the URL to open. Mike seemed pleased to be called on and was efficient, yet patient, in helping his classmates. He showed them the mistake they had made in keying in the string of letters and slashes and reminded Karen that URLs are case sensitive, that is, if a capital letter is indicated, it must be typed in as one (Observation Journal, November 5, 1996).

Samantha commented about Mike later that morning. She stated he seemed to have an "intuitive sense" about the computer and that she relied on him to assist others, which he willingly did. In addition, she mentioned that Mike was working on a long story he was word-processing (Observation Journal, November 5, 1996).

The next week when I observed the class I sat down to load my disk into Samantha's machine, but the disk got stuck. I discovered this when I couldn't get the file to open. I couldn't get the disk to budge and was worried I had created a problem that would be difficult to solve. Mike was sitting nearby, so I asked if he might assist in solving the problem. He raced over and, within a few seconds, deftly dislodged the disk (Observation Journal, November 13, 1996).

Later that same morning, a pair of girls walked over to Mike's desk and asked him a question, but I couldn't hear their query. Mike got up and went over to their station, grabbed the mouse and began

moving it furiously. I couldn't see exactly what he was doing, but it appeared that he was searching for a Web site. "There it is!" he exclaimed. "I told you it was there." (Observation Journal, November 13)

On another occasion, I wrote a URL on the board, but no one could get it to open. I double-checked what I had written, but I couldn't find a mistake. Samantha asked Mike to find the *Roanoke Times* homepage. As she rattled off a sequence of oral directions, I couldn't follow them, but Mike could. After locating the homepage, he quickly discovered two mistakes in the URL I had written on the board. After he corrected my error, everyone was able to locate the appropriate site (Observation Journal, November 20, 1996).

When the students began to use *PowerPoint* after Mike discovered it, Samantha reported that several students took the lead in new ways. One became the class expert on importing sound into *PowerPoint* presentations. Mike was the self-declared animation guru. Interest drove various students to learn aspects of the software in depth. Nothing was teacher-directed or contrived.

Samantha related incidents during this time where Mike, with great patience, taught other students how to use animation to add interest to their reports on animals. She stated Mike never refused to teach another student and seemed pleased to be the acknowledged

expert. Samantha commented on Mike's seemingly never-ending supply of patience (Observation Journal, March 19, 1997).

On one of my last visits to observe the classroom, I watched the students using various resources to locate information about animals. Students were assisting each other as needed. Someone called out for help in finding the woolly mammoth and Mike was quickly out of his seat, assisting a classmate in her search. Soon everyone was calling out Mike's name, and as he finished helping one, he called out, "Who's next?" Mike went from desk to desk as students called, "Mike! Mike!" Adept at solving everyone's problems, Mike assumed the role of facilitator easily. He whistled loudly as he wandered from desk to desk. His hands were in his back pockets as he looked at screens, offering advice. Eventually, he raced back to his desk and said, "I've got to start!" He settled down and began his own work (Observation Journal, May 21, 1997).

From the onset Mike was a willing collaborator who readily volunteered to assist his classmates. Generous with his knowledge and skills, he facilitated other students' learning. There were no reports of his denying a classmate the benefits of his expertise. Observations by the teacher, other adults, and classmates all support the interpretation that Mike relished this role and sought opportunities to give aid. His response to both students and adults was a patient one. He exhibited

no boasting or showing off, though the conclusion can be drawn that he gained a level of satisfaction from these interactions. Otherwise, he would not have been so quick or willing to respond to requests from others. Mike's enthusiasm and confidence may have been reassuring to others. If Mike could do it, so could they.

Mike's discoveries made an impact on the class as he urged his peers to try new things. Throughout the year he continued to bring in URLs he had discovered in his exploring the Internet at home. His notepad of Web addresses continued to provide opportunities for these kinds of interactions.

Samantha reported that she had no plans to teach the students to use PowerPoint until Mike began utilizing it himself, sharing with his peers as he learned. She quickly capitalized on the enthusiasm that spread as students explored on their own and naturally collaborated with classmates the various skills they had learned. Mike was the leader of this effort.

### **Social Interaction Is Impacted by Technology**

No one had to tell the students that e-mail could be used for social exchanges; they discovered that on their own. By using a group alias or listserv, a student could send a single e-mail message to every class member with little effort. The students also chose to interact with Janet, the technology aide, by e-mail in many different ways. They

often asked her for technical assistance or sent requests for her to teach them how to use their home computers in new ways. Many wrote to her for social purposes or for advice. The following e-mail from Janet highlights this:

01:32 PM 1/17/97 Janet McKnight <janet@bev.net>

Melissa, This may not be new to you, but it is interesting sociologically. This e-mail is giving the children virtual friendships that for a new teacher is a bit odd. It extends the classroom in ways that I don't think they prepare you for in college. Ponder that for the future of education—for our children and our teachers . . .  
Janet

Janet's comments illustrate how relationships between and among the children were being explored in new ways. With the exception of one or two minor incidents, the impact of the e-mail was positive. Samantha related one occurrence of a student sending profanity to another, but that was nipped in the bud after the principal confronted the offender.

In another instance, Janet sent me a request for advice. [See textboxes below.] I suggested she ask Mike if Janice had indicated why she didn't want to receive e-mail from him and to tell Mike to keep his letter friendly and non-accusatory. Because I hadn't seen the e-mail Mike had sent, I didn't know if he had sent an inappropriate message. Using the information I had sent her, Janet wrote to Mike and the matter was soon settled. She later sent me a copy of the e-mail exchange.

12:11 PM 1/18/97

Hi, Need advice on this one. How do I respond to this? I can understand how [Mike's] enthusiasm would get old with some of the kids, but I rather like it.

(E-mail from Janet McKnight, January, 18, 1997)

Mike's e-mail to Janet illustrated his confusion. He sought Janet's assistance in solving a problem with one of his classmates.

On Thu, 16 Jan 97 18:05:11 Mike <mike@bev.net> wrote:

Mrs. McKnight,

Janice said to stop e-mailing her. Could you e-mail her or call her and ask why she does not want me to e-mail her.

Mike

Janet's response to Mike followed advice I gave to her. She directed Mike to try to solve the problem himself.

02:59 PM 1/18/97 Janet McKnight janet@bev.net

Hi, Mike. I'm writing about Janice's letter asking you not to write her any more. Ask Janice why she doesn't want you to write. You might tell her that you just love the computer and like having your classmates share their ideas and stories with you. Let her know that she doesn't have to write back, or even read your mail, but you'd like her to anyway. Be friendly and nice no matter what.

Also, Mike, you might want to explain to her that when you write to the whole class she will get the same mail that everyone does, and you can't help that.

Remember, you guys are all a team, a group of friends. If she really objects, you may have to go through your address book and list each person's e-mail address separately when you send a letter. But I'd try to talk it over with her first. When you do write, make sure the subject line is appropriate so that she will know what your letter is about.

Please let me know how it goes. You might also tell her that she is welcome to write me too if she'd like to talk to me about it. I'm always here for all of you.

Janet McKnight

## **Summary**

Informal conversations with Mike told me that he continued to make discoveries on his own at home. He explained how he had

figured out how to use various pieces of software that had been loaded on the students' machines. He chose to send e-mail to me with recorded messages in "WAV" (sound) files. After receiving the e-mail, I would open the files and hear his voice instead of merely reading his words. Once I received, from Mike by e-mail, a media clip containing full motion video (Observation Journal, January, 1997).

Mike greatly increased his social interaction with his peers, often seeking them out through e-mail. Living in a rural community with working parents and great distances between his house and others', he was quick to adopt e-mail for purposes of social discourse. He initiated student-to-student contact quite often, particularly when he sent out blanket requests via the class listserv. It was e-mail Mike turned to in efforts to communicate to others when snow kept him housebound. His "all call" requests—"Is anyone out there? If so, please e-mail me," illustrate this clearly as do his many requests to Janet McKnight imploring her to send him "something to do" on his computer. Other than the one incident where Janice, a classmate, wanted Mike's attention by e-mail to cease, no other problems were reported in Mike's using e-mail for social interactions.

## **Joe**

### **Self-Directed Learning**

As I observed the class early in the year, I noticed Joe almost immediately. His facial expressions seemed to indicate that school was a painful experience for him. He never smiled and his brow was knit most of the time. In addition, Joe often emitted sighs. Joe entered fifth grade defined as at risk in three areas: mathematics, reading, and written language. In addition, Joe was a reticent child who did not volunteer in class nor did he often ask for help when confused. Introspective, Joe watched other students before he made his move to participate or to follow directions. He seemed uncomfortable and unsure of himself. If called on, Joe would often redden before answering. He would hesitate and stammer without confidence (Observation Journal, October 7, 1996).

The first week of school I administered a short survey to the students to find out what they thought of school. Joe's response to the question, "What are your favorite school subjects?" was revealing. He answered, "P.e. I like excres." He indicated that he did not like homework and that his least favorite classroom activity was to "look up stuff." Joe specified science as his least favorite subject because "It is hare for me." Though most students easily answered all the survey

questions in the time allotted, Joe was unable to complete the survey (Survey, September 6, 1996).

A few weeks after the computers had been installed, I interviewed Joe at school. I asked how he felt about having the computers in the classroom. He indicated that he thought it was "fun being surrounded by electronic things," and went on to tell me that the computer would help him do his homework because "it kind of has all the answers." Pressed for more detail, Joe mentioned that the World Wide Web was full of information (Observation Journal, November 11, 1996).

I had noticed in observing Joe that he often did not utilize the computer as the other students did. Temporarily assigned to one by himself, he would delay moving the mouse or striking keys until well after he had been asked to do so. My initial reaction was that he was either intimidated by the machine or did not like it. I broached the subject carefully, saying, "I've noticed sometimes you appear not to like when we work on the computer. Is that true?" Joe's response did not surprise me. "I like it, but I don't like it when we type all that stuff. It's hard for me when we type all the letters." Assuming it was because he was not a proficient typist, I asked if that was why. Joe's face reddened and he looked down. He spoke haltingly. "See, I'm in a reading class and I haven't learned to read good since I've been in

kindergarten.” He hung his head in silence. Unsure what to say, I blurted out, “Do you think the computer might help you learn to read better?” What Joe revealed next had a big impact on his fifth grade year. “I think it will be better because the words are on a screen and they don’t jump out as much.” I asked the logical follow-up question: “Do words jump out when you read from a book?” Joe’s response was heart rending. “Yeah, it’s frustrating and makes me feel bad. See if I’m reading to a class and I’m stuck. . . I had someone come up to me when I was in second grade and ask me, ‘Hey, why aren’t you reading fast enough?’ They were like done, and I was still on the first sentence trying to figure out a word.” By this time Joe’s eyes were filled with tears and he began blinking them rapidly. His face began to flush, and I could tell he was embarrassed. I thanked him for being so forthright and for sharing his feelings with me. Finished, Joe arose and purposefully strode outside to play (Observation Journal, November 11, 1996).

The result of Joe’s revelation was immediate. After I shared Joe’s comments with Samantha, she reported to her principal what had transpired. Barry arranged with a local optometrist to evaluate Joe for free and to donate a pair of eyeglasses if he needed them. Janet, the technology aide, accompanied Joe to the eye doctor. The optometrist prescribed for Joe a pair of glasses that contained lenses yellow tinted

but otherwise were plain glass. The yellow tinted lenses would keep the words from “jumping off the page.” When they returned from the eye doctor, Joe word-processed a letter to me. Janet helped him send it to me via the inter-school mail service. Along with the letter were two pages Joe had printed from the encyclopedia portion of the CD-ROM reference package, *Book Shelf*. The first page had an illustration showing the structure of the human eye along with information about vision. The second told all about color and included a color wheel. Joe’s letter reported a positive experience having his eyesight evaluated.

Today I went with Mrs. McKnight to Wal-Mart to visit the eye doctor. I learned that if you mix red, and yellow you will get the color orange. I also learned that these colored lenses will help me from not squinting they will also help me read and see the computer and books better. I really enjoyed meeting the doctor and being with Mrs. McKnight. (Correspondence from Joe, November 26, 1996)

Joe’s eyeglasses were a hit with the entire class. Janet reported that the other students decided the glasses made Joe look like a rock star. She and Samantha both indicated that the glasses made a big difference in Joe’s demeanor. He was far less reticent and was more willing to participate (Observation Journal, December 4, 1996).

On the afternoon of December 5, I visited the after-school class where Janet worked with small groups of children, teaching them computer skills in the context of what they had been assigned for homework. Joe did not notice my presence so I was able to observe

him without his being aware. He worked intently for over fifteen minutes his eyes moving between the book to which he was referring and the computer where he was word processing. There was no hesitancy about his movements. A few minutes before the class ended, Janet came over to me and whispered, "Do you see it? Do you see the huge difference in Joe? The glasses have certainly helped."

(Observation Journal, December 5, 1996)

Out of class Joe followed through on every single assignment I gave, e-mailing them to me as requested. He relied on my immediate responses to his submitted homework, a service I had promised the students I would perform the night the assignments were due. I was also available online to answer questions if students were confused or unsure how to proceed. At times Joe would send his homework, wait for my feedback and then make any changes or corrections before resubmitting it. Once Joe had to go out with his family right after he e-mailed his homework. He sent the following message to let me know he would not ignore any feedback I forwarded.

WE have to leave, but will be back later, and will check my e-mail then.

Joe

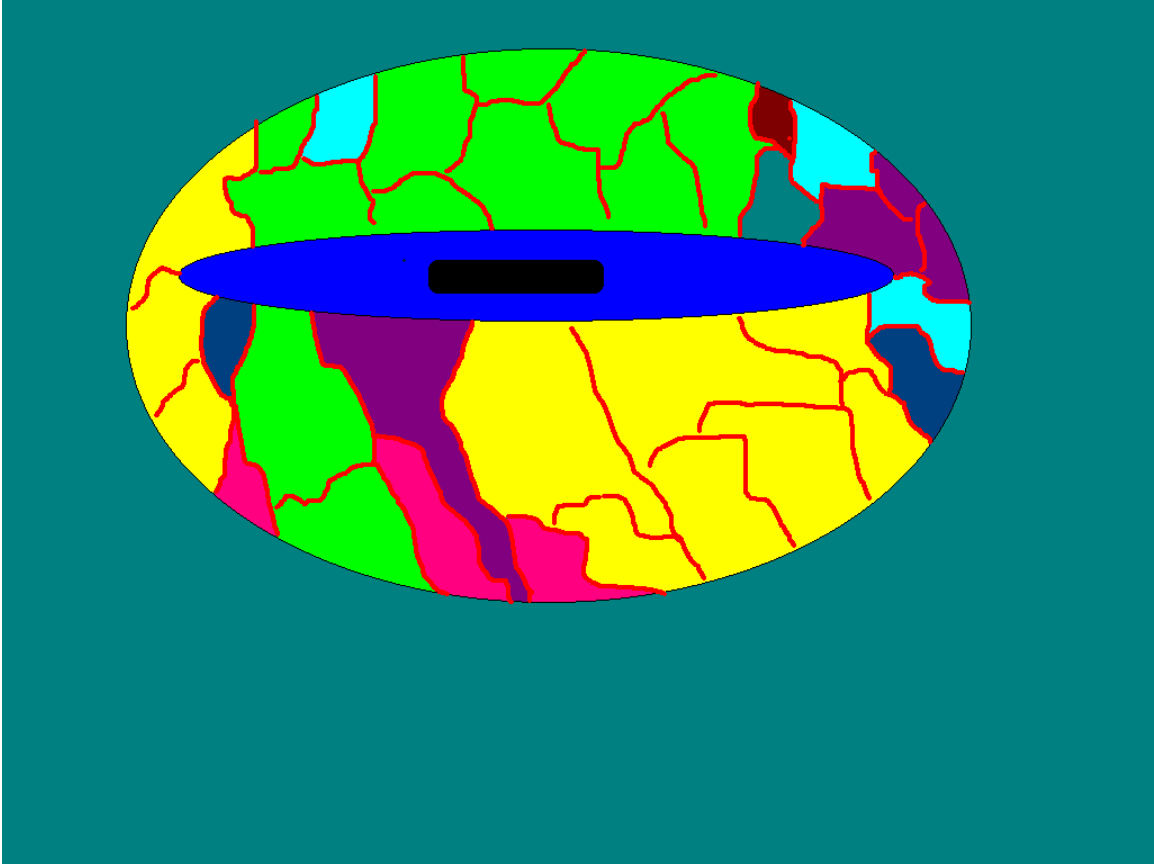
(E-mail from Joe, January 15, 1997).

Joe knew that I loved words and well-crafted writing. We had discussed this in class often focusing on examples I brought in from my own reading for students to consider. Joe began to bring to me

examples he found in his reading. He would share them with me privately before class officially began (Observation Journal, November 21 and 26, 1996). In February, Joe sent me e-mail containing a sentence he had found on his own that he liked.

Then the bruised and bedraggled bear sprawled out on his belly choking and wheezing and snorting out bubbles until at last he was able to breathe. P.S. Hope you like this Joe  
(E-mail from Joe, February 19, 1997)

The students were encouraged to explore software loaded on their machines at home when they had time. Janet often introduced the software during the after-school classes, but left it to the students to explore further. One program the students learned to use was a drawing program, *Paint Shop Pro*. With it students could create original colorful artwork. On February 24, Joe sent a message telling me his eyeball was protruding out. Attached was the following file, shown in Figure 5 (E-mail from Joe, February 24, 1997).



**Figure 5: Joe's computer art**

Joe wanted to share with me that he was exploring the drawing program on his computer in his spare time at home.

In March I went to England. Prior to my leaving, I told the class I would be gone for a few weeks and that I'd send them a challenge before I left. I e-mailed the students to tell them about my itinerary and challenged them to find answers to a few questions about England. They were not required to seek the answers or to respond to the e-mail. Joe was one of two students who chose to seize the opportunity to learn about England on his own and the only one who

answered all the questions correctly (E-mail from Joe, March 12, 1997).

Throughout the spring Joe continued to exhibit the traits of a self-directed learner. On April 20<sup>th</sup>, he sent me a query via e-mail. He was having difficulties locating the answer to a question, one unrelated to any school assignment.

Dear Ms.M,  
I looked up the NFL domed stadiums there are none that I can find. I looked under NFL Trivia. Are there any? I would like to know.  
Joe

Another time, on April 21, Joe chose to share with me by e-mail that he had been reading about birds. "I know what a emu, is it is a large flightless, native Australian bird. I have to go to bed now, see you later." Then, on the 27<sup>th</sup> of April, stumped again, Joe sent e-mail asking if I could help him find a map of Vermont on the Internet. "I can find somethings on Montpelier on the Internet, but I can't find a map. can you give me a hint?" he inquired. I replied that perhaps his CD-ROM, *Bookshelf*, would be a better choice because it contained an atlas. It was not unusual for the students to assume that the Internet was the best place to look when seeking answers to questions. Many had to be guided to ask themselves the question, "Which resource available to me is the best to access at this time?" (Researcher's Journal, April 26, 1997)

In May the class studied the Civil War and was learning about songs of the era and point of view. Joe told me in class that the songs helped him understand how people could feel differently about what was happening around them (Observation Journal, May 15). His spontaneous e-mail to me is a good example of how Joe progressed during the year.

The songs of the American Civil War told stories from the heart. They told of the struggles that families, slaves, and soldiers had. You could tell how they spoke through the songs. The songs set scenes and told how they felt and who they were. The songs helped me understand what the people went through, like "The Vacant Chair." It told how someone's husband, father, or brother had died. Leaving them feeling very lonely. The songs helped me understand that some southerners was for the Civil War and some was against it.  
(E-mail from Joe, May, 15, 1997)

It appears that the glasses Joe acquired in November were a catalyst of sorts for his school success in fifth grade. How much difference they made in his ability to focus and read I cannot determine. There is a possibility, however, that the glasses gave Joe confidence to believe in himself and to understand that he could learn. In May, Joe's mother spoke out at a meeting for parents.

This project has had a huge impact on our family. We have experienced great success in our home. We now have friends all over the world that we stay in contact with by e-mail. I am thankful. Joe is doing serious, hard work. His effort is amazing. He has loved it. He would have fallen through the cracks if he hadn't participated in this project. His reading has improved. (Transcription of Parents' Comments, May 13, 1997)

## **Collaboration**

At the outset of the project, Joe was temporarily alone at a computer. It was not long, however, before he had a partner. He continued to have a series of different partners throughout the year. In all my observations, I never noted a time where there was any disagreement between Joe and another student. He willingly worked with whomever he was assigned, but was not one to volunteer readily to solve others' problems. It is likely that Joe's slow, thoughtful response time allowed other students to move more quickly to provide assistance to those needing it. Even though he may have been able to help, fellow students were quicker to respond to requests for assistance so Joe did not. Through e-mail, however, Joe did choose to initiate collaborative efforts. As in most situations, Joe chose to observe for a good while before joining. In the spring he began to reach out through e-mail to his classmates for purposes of collaboration. Joe began to send out interesting tidbits he had found in his reading. He would e-mail his information to the entire class through the listserv. The first one he sent was about bears, a topic that interested him.

Do you know what the worlds largest bear is? It is 9ft. high and weighs over 1,600 lbs. It is the Kodiak grizzly and is found in North America.

Joe

(E-mail from Joe, March 16, 1997)

By May, Joe was using e-mail more frequently as a means to collaborate. He chose to join the very small group of students who enlightened each other about interesting facts they were learning through their own discoveries. Joe did not send his facts in question form awaiting the responses of others. Rather, he provided the information directly as in the following e-mail from May 16, 1997.

Here are two fun facts, because I had ball practice last night, and it was late when I got home. 1. What year was the Statue of Liberty put into New York Harbor? The year 1886. 2. The first steam locomotive to pull passengers was called "Tom Thumb."

Joe

On May 20<sup>th</sup>, Joe did something no one had done previously. He used e-mail in a new way. Joe chose to use the medium in a collaborative request.

Can you tell me were I can find some information on the water striders data? I have been sick for two days and I haven't been at school. Thanks. Joe  
(E-mail from Joe, May 20, 1997)

I had no access to e-mail sent directly to students unless it was posted on the listserv. Thus, I have no record of who responded to Joe, but I do have his response back to the class. The time between the request and his thank-you was about four hours.

Thanks to everyone who sent me e-mail. I found what I needed to know. Joe  
(E-mail from Joe, May 27, 1997)

His message indicates that he had heard from more than one student. In turn, Janet McKnight, the technology aide was excited by

this novel use of e-mail that had evolved naturally. She sent me the following message.

Look at the e-mail—have these children found an access to school, to one another, to an interest in getting the work done!?!?! I KNOW these kids have benefited from this experience. Janet  
(E-mail from Janet McKnight, May 27,1997)

### **Social Interaction Is Impacted by Technology**

Joe's family was close knit and they spent much time involved in church functions. They regularly engaged in family-oriented activities. Joe was a quiet, introverted child. He was not one to reach out to others. Not unfriendly, Joe was merely reticent. It was in February when he first used the technology to interact socially with his classmates. A heavy snow had closed schools for a few days.

Just a note to say Happy Valentine's Day to all of you. Hope you enjoy your day at home!!! Joe

Later that same day I received a personal message from Joe. He said, "I really like having a marvelous teacher like you," and signed the message "Your Friend, Joe." (E-mail from Joe, February 14, 1997) In April, Joe was excited to tell me the big news about Virginia Tech's quarterback, Jim Druckenmiller. Rather than wait until the next time I was visiting the class, Joe sent e-mail.

Jim Druckenmiller was drafted in the first round by the San Francisco 49ers. Your friend' Joe  
(E-mail from Joe, April 27, 1997)

On May 13<sup>th</sup>, after the meeting with parents, Joe's mother chatted with me. She indicated that the entire family was now able to communicate effectively with missionary friends in other countries through e-mail. Joe very much enjoyed participating in this family activity, she reported, and looked forward to the e-mail exchanges. The family now had a medium that was both free and expedient in corresponding with friends in faraway places (Observation journal, May 13, 1997).

### **Summary**

As reported by his mother, fifth grade was a good year for Joe, and the project impacted him in positive ways. The tinted glasses helped Joe in his efforts to learn to read better and may have been an indirect catalyst in boosting his confidence. Joe's mother believed that his effort was "amazing," as reported at the parents' meeting.

Like his classmates, Joe became facile at using many different software packages including Microsoft *Word*, *Paint Shop Pro*, *Bookshelf*, *Internet Explorer*, and *PowerPoint*. He learned to word process and regularly used the spell check feature. Joe also used *Word* to create tables and took advantage of the many formatting tools available to him. He utilized the features of *Paint Shop Pro* for creating artwork and for processing and retouching scanned images. Joe became proficient using e-mail and was one of the students who

accessed it regularly. He used e-mail in various ways both for school projects and for social interaction. Often, Joe would attach files to his e-mail. In addition, he mastered transferring files between his home machine and school rather than transporting disks back and forth. The skills he learned in using the tools available to him can be utilized in the years that follow.

Joe's confidence rose as evidenced by his being more prompt in responding to direction and by his increased willingness to volunteer in class. He became more self-directed as evidenced by his eagerness to share his new learnings via e-mail messages to me and to the class listserv. Joe became exceptionally conscientious about making sure he understood all assignments and was able to complete them on time. He chose, without being prompted, to use the medium of e-mail to obtain needed information to complete assignments given while he was absent from school.

## **Lizy**

### **Self-Directed Learning**

Lizy caught my attention the first time I visited the classroom. She was sitting with another student, and I moved to where they were working to see what they were engaged in. As I approached the girls, I looked at their posted nametags so that I could call them by their correct names. I was puzzled by the spelling of Lizy's name and

observed that it had been written a bit crudely for a fifth grader. After she pronounced it for me—it rhymes with tizzy—I was concerned that she had, perhaps, misspelled it. I asked Samantha about it and was told that was the way Lizy's mother had chosen to spell her daughter's name. I learned, too, that the family, of very modest means, had no telephone so the FIS project provided one (Observation Journal, September 23, 1996).

Lizy was always eager and alert, quick to volunteer when given the opportunity. Her contributions, at times, missed the mark, but this did not dampen her enthusiasm. She was generally a quiet student who whispered when talking to her peers during working time. I never observed her blurting out in class. Lizy attacked every assignment with great energy and brought each task to completion. Her handwritten work was below average and she did not spell or punctuate correctly as a matter of course (Observation Journal, October 23 and November 7, 1996).

Lizy was one of the first students who began to explore the varied formatting options of the word processor. She was an early adopter of many word-processing features that she discovered on her own. Two early pieces of writing I received from her that were word-processed included a table categorizing invertebrates into different groups and a wish list for Christmas. In both documents Lizy used

fonts that were different from the standard font used by the rest of the class, and the Christmas list had an imported graphic, a large book centered on the page. Lizy used the underlining features as well as italics and outlined letters. In addition, not one of her words was misspelled indicating that she was using the spell check feature. Another convention Lizy utilized was surrounding a phrase with asterisks, a technique often used in e-mail to emphasize a point. In her Christmas list, her last item was written thusly: \*Get over my cold.\* Because e-mail was not available to her at this time, I believe she devised the emphasis herself. Lizy's list included these items: a good book, a quiet place, and a place all to myself. When asked the significance of those requests, Lizy replied that she wanted a quiet place at home where she could concentrate on her homework and reading for pleasure. That helped explain another request on her list, My sister to leave me alone. Lizy indicated that her sister often interrupted her work and wouldn't leave her alone particularly when she wanted to read (Observation Journal, December 17, 1996).

Right after winter break, Lizy showed me a CD-ROM she had received as a Christmas gift. In game format the CD-ROM would provide the user with opportunities to learn about historical events. She told me she was excited to use it because she wanted to learn as much as she could about history. "This game will really help me

because you have to know your history to play this game.”

(Observation Journal, January 8, 1997)

When e-mail became available, Lizy began to use it immediately. The students learned the ins and outs of using e-mail, and it quickly became an avenue for social discourse. Janet reported that students were immediately—after learning to use e-mail—sending her jokes and personal messages. Lizy was the first to do so and was the most prolific correspondent (Observation Journal, January 15, 1997).

Again, in her e-mail Lizy included conventions that she devised herself. “How do you like it?” she asked in an e-mail message that included a new addition to her signature file:

How do you like it?

---

Alabama-Alaska-Arizona-Arkansas-California-  
Colorado-Connecticut-Delaware-Florida-Georgia-  
Hawaii-Idaho-Illinois-Indiana-Iowa-Kansas-  
Kentucky-Louisiana-Maine-Maryland-Massachusetts-  
Michigan-Minnesota-Mississippi-Missouri-Montana-  
Nebraska-Nevada-New Hampshire-New Jersey-New Mexico-  
New York-North Carolina-North Dakota-Ohio-Oklahoma-  
Oregon-Pennsylvania-Rhode Island-South Carolina-  
South Dakota-Tennessee-Texas-Utah-Vermont-Virginia-  
Washington-West Virginia-Wisconsin-Wyoming!!!!!!!

~~~~~

(E-mail from Lizy, January 17, 1997)

When I first looked at the e-mail I thought perhaps Lizy had cut and pasted the list from another file, but after noticing the misspelling

of Idaho and Louisiana as well as the numerous exclamation points at the end, I concluded she must have laboriously typed in all the letters herself. Another clue was the time the e-mail had been sent—right before midnight. Because she could not touch type, Lizy must have spent quite a while hunting and pecking as she keyed in each state. Because she was not a proficient speller, it is likely she sat with a book and laboriously copied letter after letter. She included this creature as an appendage to her signature file for a few days before switching to other emoticons she devised using letters and characters on her keyboard. In addition, Lizy included a pithy saying:

```
      [..]
-----oo0-----0oo-----
Name: Lizy
E-mail: <Lizy@bev.net>
Date: 1/27/97
Time: 9:11:07 PM
Life is to short to complain.
-----()------()
```

(E-mail from Lizy, January 27, 1997)

Soon after, a new creature appeared in her e-mail, a rabbit. Her entire message to me stated, "E-mail me. Please. Look down." Lizy wanted to share her new creation and was seeking feedback.

---

```
xx          xx
  xx        xx
    xx      xx
      xx    xx
        xxxxxx
          xxooxx
            xx00xx
              xxxxxx
                xxxx
                  xxxxxxxx
                    xxxxxxxxxxxx
~~~~~
  oo0      0oo
Name: Lizy
E-mail: <Lizy@bev.net>
This message was sent by Lizy
~~~~~
  oo0      0oo
```

As time went on, it became a daily occurrence for me to receive e-mail from Lizy where she shared an endeavor she was pursuing at home on her own. She began attaching files, most of which contained original work that had not been assigned. Her signature file changed regularly as she devised new creatures to include, each one becoming more complex than the previous. Lizy attached different types of files to her messages. Often, they were original works she had written, but at other times they were photographs or images she had downloaded from the Internet. By February Lizy was scanning photographs of herself and e-mailing them to me (Researcher's Journal, February 22, 1997).

Lizy told me in one message that she loved to "surf the net," and it was not long before I began to receive from her electronic postcards

and greetings from Internet sites I then had to access in order to “pick up” her gifts. She was tenacious about following directions given on sites and making use of available resources. When asked how she learned to use these features, she told me, “I read the directions and keep trying until I get it right.” (Observation Journal, February 23, 1997)

Like Joe, Lizy knew I liked descriptive words. I responded to one of her many e-mail messages with a suggestion that she send me interesting words she bumped into as she read or surfed the net. The next day, I received the following message as a file attachment to one of her e-mail messages. Per usual, I was instructed to “Look down.” This meant I needed to look for the included path of the file attachment and find it in the network directory on my computer.

Dear Ms. M,  
I have just made a great discovery. I was looking up The Trial of Tears for homework, and in the document I found it had the most amazing word I've ever seen. The word was subjugation.  
The Cherokee Indians and other tribes came under the subjugation of the white man's laws. In the Treaty of Indian Springs the government took the Native American's land for the white men. After they were moved from their home-land, they were forced off that land too, when gold was found.  
Love, Lizy

Lizy had taken great pains to write this message. With great excitement she initiated sharing her finding. It is clear that she used the spell check feature as all the words were correctly spelled. She either selected the wrong word for “trail” and used “trial” by mistake

or she simply misspelled the word to begin with as the spell check feature will not catch misuse of a wrong word spelled appropriately. Not only was Lizy researching for homework, she was focusing on the use of interesting words.

Lizy continued to be on the alert for words she found interesting, and she often sent them to me. On February 10, I received a message that stated, "I found another interesting word. I know that brief is used all the time, but it is a descriptive word. I have a sentence for it and here it is:

In our brief history, we had relatives. Our relatives were called natives, savages, but we know them best as Indians. Some Indians were forced to leave their own land because white men had found gold. Gold that was useless to the Indians. I have a question for everyone, How would you have felt if Indians had forced us off our land? Thank about that then thank about how the Indian's felt."

I checked the header to the e-mail and found that Lizy had copied the message to all her classmates via the class listserv. Not only was Lizy pursuing knowledge on her own, she was sharing it with other students and prodding them to think.

### **Collaboration**

As in the e-mail message highlighted at the end of the previous section, Lizy often collaborated with her classmates via e-mail. She was also helpful to others in class when asked, but was not one to seek opportunities to assist others unless it was her partner or a student sitting nearby who needed assistance. At times she would

bring things in to share with me, items that related to her own pursuit of learning outside of school. If I asked her to share her findings with the class, she was always willing to do so and seemed quite pleased to be asked. She never initiated opportunities to share with the class, although she may have approached me knowing I would suggest it.

Early in the year, Lizy stopped me as I passed by her desk. She wanted me to see the pages relating to exploration—a topic the class was studying—that she had located on her own and bookmarked (Observation Journal, November 7, 1996). In late February, Lizy showed me an old, ragged paperback about Montgomery County she had discovered at home. She had fairly memorized it in her eagerness to share her new knowledge with me. Again, this was something Lizy was pursuing on her own; no assignment from Samantha or me was connected with it. When asked to tell her classmates about her finding, Lizy told the class, from memory, information she had learned from the book. Immediately, other students became interested and wanted a chance to peruse the information. Lizy willingly shared and students took turns reading about Montgomery County (Observation Journal, February 26, 1997).

That same morning, a student made an interesting comment to Lizy as she came into the classroom. “Hey, Lizy,” she called out. “You need to capitalize the word ‘I’ in your e-mail. Everyone knows ‘I’ is

always capitalized.” Lizy shot back, “Okay, but you need to remember to put periods at the end of your sentences. I can’t figure out what you are saying when you don’t use periods because everything just runs all together.” (Observation Journal, February 26, 1997)

Through e-mail, Lizy initiated collaboration quite often. She sent to the listserv learnings she was anxious to share. At times it was new words she had discovered, at other times it odd facts, photos she had scanned, or addresses for pages she had discovered. In May, several students were actively seeking unusual facts to send out for all to see. Lizy was the most active in doing so. I, too, joined into the activity and used the listserv to distribute oddities I uncovered. Lizy wanted to ensure that I had plenty from which to select. She e-mailed me stating, “Ms. Matusevich, for your fun facts you can use my book, *Who Put the Butter in Butterfly?*” (E-mail from Lizy, May 14, 1997)

Chatty in her messages, Lizy generally gave a short introduction prior to including the information she was teaching the others. Her first e-mail message containing an unusual fact began, “Today is the first day that I have sent a fact so I’ll give it a shot: Where dose the cole in coleslaw come from?” Then, she gave a fairly lengthy explanation:

Cole hase nothing to do withclod. Coli means “cabbage” in Lati and sla means “salad” in Dutch. The Dutch word koolsla, appropriately enough, means cabbage salad.

(E-mail from Lizy, May 14, 1997)

The next day, Lizy submitted another fact to the class via the listserv. This one evoked chatter as students arrived in class the following morning. "Ewwww, Lizy, that fact you sent was creepy. Cooties—yuk!" (Observation Journal, May 16, 1997)

Here I am again, my fact for the day is: What are cooties and where do they come from? Well, in War World I they started using the term cooties instead of saying you had lice. Cooties are head and body lice. Neat, isn't it.  
(E-mail from Lizy, May 15, 1997)

Then, Lizy added others to her mailing list. These included the student teacher, a researcher, the technology aid—Janet McKnight, and the gifted resource teacher. On May 16<sup>th</sup>, she enlightened everyone as to the origin of the term "checkmate."

Heres my fact of the day. Why do we call the last move in Chess, Checkmate? Checkmate comes from the Persian word, shah-mat, meaning "The King is dead."

The pace increased. On May 20<sup>th</sup>, Lizy sent out three facts. She began her e-mail message with an exclamatory remark—"I have 3 facts today!"

1. John Quincy Adams our 6<sup>th</sup> president went skinny dipping every morning.
2. Thomas Jefferson our 3<sup>rd</sup> president hated dressing up so much that he sometimes wore his bathrobe and slippers to dinner parties!
3. When William Howard Tuffy our 27<sup>th</sup> president was so big he couldn't fit into the White House bathtub. He had a new tub installed, a tub big enough to hold 4 people!

I do not know what prompted it—perhaps feedback e-mailed to her—but a short while later, Lizy submitted a second message correcting the first: "On fact #3 I made a mistake the mistake is Tuffy is really Taft." (E-mail from Lizy, May 20, 1997)

Lizy's willingness to use e-mail to collaborate had an immediate effect on other students. Within a week of her efforts, six other students joined in the conversation and began locating and sending out facts for all to enjoy and to learn from. Lizy, then, served as a catalyst for her classmates who took the lead from her (Researcher's Journal, May 22, 1997).

### **Social Interaction Is Impacted by Technology**

It should be remembered that Hawthorne Elementary School is located in a rural area with students' homes often situated in remote locations. It is common for both parents to work and for students to have little opportunity to play with peers after school. E-mail offered these students a new way to interact with each other socially and many took advantage of this opportunity. Through the class listserv, a student could contact every single classmate with one e-mail message. Lizy was one of the first students to avail herself of this opportunity as reported by Janet McKnight earlier. Not only was she prolific in writing to the listsev, Lizy reached out to her teachers. On February 10, I received the following message from her, one that was purely social in nature.

Ms. M, I try my best. Happy Valentines Day!

---

```
      xxx  xxx
     x   xxx  x
     x  o   o  x
       x     x
        x   x
         x0 0x
          xxx
```

~~~~~oo0~~~~~oo0~~~~~  
Name: Lizy  
E-mail: lizy@bev.net  
This message sent by Lizy  
~~~~~oo0~~~~~oo0~~~~~  
(E-mail from Lizy, February 10, 1997)

One January morning, right after e-mail had become available to the students, Lizy wrote to me inquiring as to what I was doing. I wrote back saying I was alone in the office, the day was gray and cloudy, and that it was lonely with no one around. Within minutes a response arrived. "You said you were lonely so I am e-mailing you!" Attached was a file with an assignment she was working on (January 9, 1997).

Lizy continued to reach out to others through e-mail, often sending complex files as attachments. It is obvious from the complexity of her mailings that she spent much time and effort in reaching out to others. School was closed on Valentine's Day because of snow. Lizy seized the opportunity to send out a bogus party invitation in jest. She indicated in the message that she realized it would not be possible to actually have a party (E-mail from Lizy, February 14, 1997; see Figure 6).



HAPPY VALENTINES DAY.  
LETS HAVE A PARTY .  
LETS DISCO.

WELL WE CAN'T AND THAT IS NOT FUN. WELL  
SAYING GOOD BYE NOW. NOT!!!!!!!!!!

**Figure 6: Party invitation from Lizy**

Lizy sent me a Valentine by e-mail that she had created using the drawing program on her computer. She varied color, font type and size, and filled in the outline letters with color. She centered her drawing on the page and e-mailed it to me as an attachment. Then, she wrote to me and asked if I liked her creation (E-mail from Lizy, February 14, 1997).

### **Summary**

Lizy's eagerness to learn spilled over into her home life as she spent much time actively seeking knowledge. Not only did Lizy find resources on her own—the paperback book about Montgomery County is but one example—but she readily utilized ones given to her like the atlas I distributed to the class. She devoured books containing odd

facts and generously offered to lend them to other students and to me. She explored every formatting feature available to her on the word processor and utilized the features as a matter of course in her written work. On her own, she scanned photographs of herself and sent them to various class members and to me. Lizy used every opportunity available to her to further her own learning.

Lizy was a natural collaborator from the outset. Her willingness to lend resources and her infectious nature led to her personal books circulating through the class as other students perused them during free reading time. A natural collaborator under normal circumstances, Lizy furthered her ability to work with others by accessing them through e-mail. She reached out to one and all in efforts to enthusiastically share what she was learning on her own.

I received more e-mail from Lizy than from any other student. She was also the student who used the medium in the most creative manner. No other student went to the lengths she did to change her signature file, attach files, import graphics, send scanned images, create original artwork using the drawing program, and vary the formatting in word processed files. The transfer of learning from other settings into her e-mail highlights how highly motivated Lizy was in putting new learning to work. Lizy did far more than reach out via e-

mail for purposes of social interaction. She also utilized the medium as an extension of the classroom.

## **Missy**

### **Self-Directed Learning**

Missy is a child who caught my interest by my second visit to the classroom. Tall for her age with large brown eyes, she had an air of being older than her classmates. She had attended many schools; this was her first year at Hawthorne. Missy now resided in a remotely located trailer with her mother, an older sister, and Mom's boyfriend. I sensed in Missy a yearning to learn, indeed, she was the child who later beseeched the gifted resource teacher to help her so that she could become smart.

Samantha's comments about Missy are telling. I had asked Samantha what effect, if any, she believed the Field Initiated Study would have on Missy.

I think it will open up so many avenues for her. She is a very capable person. She wants to please. She probably hasn't had a lot of advantages. I see this as really giving her a little boost in her education. She's not really that poor but she hasn't had a lot of advantages. So I feel that this will give her some. She will be able to go to the Smithsonian whether she ever gets to Washington D.C. or not. I mentioned her name to Agnes Sunderland, the gifted resource teacher, yesterday and she said, "Oh I think I know who she is. I think she is the tall girl with the long dark hair, who said to me, 'I really want to do better. Will you help me learn how to do better so I can be smart?'" (Interview, December, 1996)

I asked Agnes Sunderland about her conversation with Missy that had been reported to me by Samantha. Agnes said, "I was struck by her sincerity. The girl begged me to help her 'become smarter.'" (Observation Journal, December 17, 1996)

The first report card went home in early October. Samantha remarked that it was rare for a student to ask questions about his or her grades or comments by the teacher. That was something parents usually did. Samantha went on to say that she was a bit surprised when Missy asked to discuss her report card. Missy wanted to know the meaning of one of Samantha's comments. She told Samantha that she wanted to improve so she needed to know what it was her teacher had intended by the comment (Researcher's Journal, October 9, 1996).

I interviewed Missy at school in late October, not long after the hardware had been installed in her home. I asked her to tell me what happened once the computer had been set up and was accessible to her. She reported that she had played games and located an online newspaper for her mother. I then queried as to whether or not she thought her computer might become a tool for learning. Her response indicated that she thought it would.

I think it will help me learn and understand how to do reports and understand the computer and the dictionary and the encyclopedia and I also think it will help my sister on her keyboarding and her schoolwork. I've always

wanted a computer for my birthday or Christmas, but my mom never had the money and she said, 'Maybe when I get my income tax check I can buy you one.' Now she doesn't have to. I'm glad to have a computer. I'll use it on schoolwork and in the summer I'll probably play games and probably practice my keyboarding more. (Interview, October 25, 1996)

I asked Missy how she felt about being in a new school for fifth grade. Her response was that fifth grade was "great." She continued, "I am learning more now." I asked how she knew she was learning more. Missy shrugged her shoulders and stated, "I can just tell. I know a lot more than I did when I got here." (Interview, October 25, 1996)

Notes made of classroom observations illustrate Missy's commitment to learning. Upon entering in the morning she would immediately sit down and begin reading an online newspaper. Other students would often visit socially before being reminded that they needed to read the news. Any free time students were given in the classroom was spent by Missy reading books or Web pages about topics being studied (Observation Journal, September 13, 1996; October 30, 1996; November 4, 1996).

At first Missy was reticent about answering questions or speaking up in class (Observation Journal, October 23, 1996, October 30, 1996, November 4, 1996). This could have been related to her being a new student in a new school. By January, however, she began to speak up more, often volunteering before being called on to speak. One

February morning I checked the assignment board as I entered the classroom and learned that the class was reading an online newspaper about President Clinton's "State of the Union" address. The students were to write three of the president's ideas for the future in preparation for discussion. Students sat copying words from the news article, some unsure of what the words meant. This was evident when they were called on to report about what they had read. Most students read aloud what they had written on their papers and stumbled over words they did not know. Missy volunteered to report her findings. She did not refer to her notes. Rather, she confidently spoke from memory. Missy deftly paraphrased what the president had stated illustrating her depth of understanding. She was the only student that morning to report from memory what she had read, synthesizing it into her own words clearly illustrating she understood what she had read in the newspaper (Observation Journal, February 5, 1997).

In January the students began to use e-mail to send me the homework I assigned when I visited the class and taught a lesson. Missy never failed to complete assignments and to send them to me—with one exception. On this occasion she did not have the appropriate materials at home to conduct the science experiment I had asked the students to try on their own. Her e-mail illustrates that she was

conscientious in responding even though the assignment was not completed.

Mrs. M, I did not get to do the assignment because I did not have food coloring. My mom is going to the store one day this week and I will ask her if she will pick up some. Thank you for teaching me and taking your time!!!!!!!!!!!!!! Missy

Missy continued to put forth exceptional effort in her desire to become a good student. An assignment was given that was to be completed at home using a specific Web page. Students were to write geographic clues about a state, and I was to determine the state and e-mail my answer back. Missy's clues were good ones, but she had a bit of trouble understanding the written assignment.

07:18 PM 1/15/97 Missy <missy@bev.net>  
Mrs. M.,  
Hi it is me Missy from 5<sup>th</sup> grade. I picked 3 states and 5 clues.

Population: 18,378,000  
Flower: blue bonnet  
Bird: Mocking bird  
Inland water: 84,790 sq. mi.  
Motto: friendship  
CAN YOU GUES THE STATE?

W.B.S.- - - - - MISSY

PS  
I am not shore on this paper  
that says HOMEOWRK Do you want me to give you the other 2 states?

                                          (o o)  
\*\*\*\*\*ooO-(-)Ooo\*\*\*\*\*  
Name: Missy  
E-mail: Missy <missy@bev.net>  
HEY PEOPLES!!!!!!  
\*\*\*\*\*(-)-(-)\*\*\*\*\*

I responded to Missy immediately telling her that one set of clues was sufficient and that I'd e-mail her again once I had determined the name of her state. Later, I e-mailed the answer. Her immediate response followed:

Mrs.m that is correct

Missy

YOU WORK HARD!!!!

Missy's e-mail correspondence was prolific. She wrote more often than most of the students in the class. When she was confused she asked for assistance by e-mail, something other students rarely did. The following exchange highlights this.

Dear Ms. M,  
I don't get what you are saying on the questions can you help.  
Missy

The students had questions they were to answer for homework and then e-mail to me. Missy was stumped, but I wasn't certain why. It seemed she did not understand what a canal was, so I responded asking her.

Dear Missy,

Do you know what a canal is? Find that out first using your encyclopedia or dictionary and then write me back.

Ms. M.

Missy's response back to me illustrates that my question must have led her astray. Persistent as always, however, Missy responded.

Her e-mail shows the enormous effort she went to to try to understand the homework.

Ms. M,

I looked it up in the dictionary and I got all kinds of different things tell me if any of these are right:

alimentary canal

birth canal

harersian canal

resin canal

root canal

semicircular canal

spinal canal

stone canal

vertebral canal

Caledonian canal

canal zone

Da Yunhe---I don't understand what this one means\

erie canal

grand canal

Hood canal

Lynn canal

New York stte barg canal

Panama canal zone

Portland canal

rideau canal

suez canal

trent canal

and last but not least the Welland ship canal.

Now I will be right back with the encyclopedia

I looked on the computer and could not find anything but there are some.

W.B.S.---Missy

For a child who was not a proficient touch typist, the above message required quite a bit of effort. Not only was Missy willing to try to figure out the meaning of the word, "canal," she was also eager to

have me help her discern if she was headed in the right direction. Her tenacity illustrates, again, her commitment to learning.

Missy was also quick to incorporate into e-mail the computer skills she was mastering. Often, when she had learned how to use her computer skills in a new way, Missy would send e-mail telling me about it or illustrating use of the skill. The following message shows her understanding of two skills—using the spell check feature of the word processor and attaching files.

Mrs.Matusevich,

This is the homework I had to turn in. Sorry I had to turn it in today because I had to get instructions. I think that is how you spell it. I will use the ABC checker in a minute. Please notice the attachmquent at the bottom of the screen!!!!

W.B.S.—Missy

Content-Type: APPLICATION/msword; SizeOnDisk=11776; name="Science Demonstration .doc"

Content-Description: Science Demonstration.doc

Attachment Converted: E:\HOME\MELISSA\Network\Science Demonstration.doc

Missy followed up if she did not hear back from me immediately.

Generally, I spent two or three hours in the evening logged on to receive e-mail and to send back a response or help right away. One Sunday, I was not at home when Missy sent her homework to me. When she did not get an immediate response, she did something no other student ever did. She questioned whether or not I had received it. Apparently she did not consider that I might not have answered

because it was Sunday afternoon and was busy with other activities. Rather, she seemed concerned that her homework might not have reached me.

Mrs.M.,

I sent my homework and you have not replide. I was wondering did you get it?  
W.B.S.---Missy

(E-mail from Missy, February 9, 1997)

Like Mike, Missy became skilled at using the various software packages available to her. She was able to word process effectively, though she did not always remember to use the spell check feature. She, too, could send WAV files, import graphics, attach files to e-mail, create tables, utilize the reference works on the CD-ROM, create artwork, format tables, and create *PowerPoint* presentations. She initiated feedback from me via e-mail on a regular basis. When confused, she asked for clarification of directions. If there was something she did not understand, Missy always asked for assistance. She took learning seriously and made every effort possible to increase her knowledge.

### **Collaboration**

New to the school, Missy did not know other students well. Her shy nature seemed to keep her from reaching out to others. She lived in a remote location, so had little access to other students away from

school. She was quick to interact with teachers, but less so with other students. While she did not initiate much contact with other students in the classroom, she responded well to her classmates and worked efficiently and cooperatively with them. Missy was serious about learning and put forth her best efforts at all times. Her industriousness served to influence positively all students to whom she was assigned as a partner.

Missy was a willing collaborator who worked well with any student she was teamed with. Somewhat reticent, she did not dominate partnerships but was always willing to assist her classmates as needed or requested. On one occasion, I asked Janice—Missy's partner at the time—to find a word in the dictionary for me. Janice reached into her desk and pulled out her big green dictionary. When I asked her to use her electronic dictionary, she used *Internet Explorer* to access the World Wide Web. When I suggested that the dictionary was probably not part of the , she asked, "Let's see . . . how do I get the electronic dictionary?" Missy told her where to look, and guided Janice as she quickly accessed the on-line version and helped me find the word I was seeking (Observation Journal, November, 7, 1996).

Missy found it far easier to collaborate by e-mail with the lines often blurring between collaboration and social interaction. E-mail

opened a new world to her. She could reach out to her entire class with a few keystrokes.

### **Social Interaction Is Impacted by Technology**

Usually a quiet and shy student in class, Missy was quite social in her e-mail. Her signature file illustrates this. Missy was one of the first students to begin to use the lingo common to more sophisticated e-mail users. In her correspondence to me one January evening, soon after e-mail had become available, Missy used the abbreviation "W.B.S." for "write back soon." She also created a picture of a monkey using letters and characters. It surrounded the information she included in her signature file at the end of her messages.

```
          (o o)
*****ooO-(_-)Ooo*****
Name: Missy
E-mail: Missy <missy@bev.net>
Date 1/15/97
Time: 7:27:53 PM
HEY PEOPLES!!!!!!
*****(-)——(-)*****
```

In early February I received the following e-mail from Missy. It was spontaneous and unsolicited.

Mrs,Matusevich,

Well, My dog Lady had fore puppies. We have all ready got rid of three of them. We kept the runt of the bunch. Here is were the story begins: The puppy was outside and I hard it crying. So I rushed out to see what was wrong with it. I had found that the puppy had been attacked by a bigger dog Zo. Zo had struck the puppy with her paw. It was right above the puppies eye. If the nail of Zo's went in a little more it probably would of took the hole eye out. We took it to the vet and they said Sheba's eye was going to be okay. We just have to give her a pill and some kind of cream. I am glad to say now that I think she is getting better. The

only reason I say that is because she is acting very spunky. That means better, happier, play full, and a lot more things!!! THIS IS A TRUE STORIE!!!  
W.B.S.---Missy

In late spring I obtained an assortment of reference works, most of them desk atlases. I distributed them to the students and told them the materials were theirs to keep. Most of the students showed initial interest, but a few were open about not appreciating the gifts. Missy took pleasure in the atlas she received, and that evening at 6:31 PM sent e-mail to the entire class.

Mrs.M. gave me this atlas and it is really cool. It tells you these countries how they speak and everything. Well I was looking through Virginia and did you know:

- \*That the largest cities in Virginia are Virginia Beach, Norfolk and Richmond.
- \*The Smallest town is Duffield. (There population is 52)
- \*How much fresh water is used: 762 gallons/ day/ person. (average)
- \*How much garbage per year: 8,000,000 tons a year!!!
- \*28% of that is recycled.
- \*Mother of presidents is a nickname given to Virginia because eight presidents of the United States were born here.
- \*The first permanent English settlement in America was founded at Jamestown in 1607.

There are some facts about Virginia.

W.B.S.---Missy

Missy sent another e-mail message to the class that night, but much later. She apologized for sending it so late; it was almost ten o'clock. When I talked to Missy the following day she said she had found the atlas so fascinating, she couldn't put it down and that she felt compelled to share what she thought to be interesting with the entire class. She went on to describe how she had referred to the atlas

over and over sharing various pieces of information with her sister and then her mother (Observation Journal, May 15, 1997).

Subject: fun fact

To: \_All Students, Melissa Matusevich <melissa@bev.net

Sorry this is so late but hear is another fun fact. It is about Alabama.  
Three largest cities---Birmingham, Mobile, and Montgomery  
Smallest town---Gannts Quarry---there population is 2!!!!  
Fresh Water used---2,000 gallons/day/person (average)  
Garbage---5,310,000 tons per year---15%is recycled

There is some things about Alabama

W.B.S.---Missy

Missy's eagerness to share what she was learning had a positive impact on the rest of the class. One by one several other students jumped into the e-mail conversation pointing out items of interest from what they were learning. I joined in whenever interest seemed to wane. Usually, whenever I would e-mail an unusual fact, Missy would respond immediately. She often made a comment, and if there was something she did not understand, she would ask a question.

I didn't know that neither did my mom so you tought us both something . . . !!!!

W.B.S.--- Missy

I don't get what you are saying can you help?

W.B.S. - - - Missy

Once I e-mailed a fact to the class stating that Mohammed is the most common first name in the world. I asked if anyone had any ideas as to why that might be. Missy was the only student to respond. She

conjectured many things and added a PS to her message. After her usual string of exclamation marks Missy added a row of smiley faces made by inserting a colon followed by a close bracket.

Could it be that Mohammed is the most common name because Well it could have been a slave name china name American name Africa name (maybe) And Canada name. The reason I say Canada is because when the slaves escaped they well most of them went to Canada. Am I wright? Please write back soon:)

Missy

PS.

Interesting fact!!!!:}}}}}}}}

### **Summary**

While I was in England during March, I did not communicate with the students as I had no Internet access. Upon my return, Samantha shared with me information about Missy. During my absence, the relationship between Missy's mother and her boyfriend fell apart and the family—mother and two daughters—moved to a neighboring county. They turned Missy's home computer into the school office on their way out of town.

Missy was distraught and unhappy in her new school. She implored her mother to return her to Samantha's class. At the end of two weeks her mother acquiesced because of Missy's extreme unhappiness. She moved the family back in with the boyfriend on the condition that they all participate in family therapy. Relieved to be back in Samantha's class, Missy picked up where she had left off. The

home computer was reinstalled and Missy finished fifth grade at Hawthorne Elementary School (Researcher's Journal, March 20, 1997).

Missy adapted to using the computer both in the classroom and at home. It was she who was first to use emoticons in e-mail to show joy or laughter. She learned them on her own as these were not taught in school. Conscientious, Missy put forth much effort in completing schoolwork and homework to the best of her ability. She sought out others in efforts to learn—first, Agnes Sunderland, the gifted resource teacher, and then Samantha to find out how she could have an improved report card. Missy also interacted with me in efforts to learn though most often by e-mail where she had my undivided attention. In class she had to compete with twenty-three other students. Through e-mail Missy became more gregarious and outgoing than she demonstrated in class. As the year progressed, her confidence grew as evidenced by the observation of her reporting about the "State of the Union" address. The hesitancy she had exhibited earlier in the year was no longer visible.

Missy's use of the computer and the software packages available to her was as extensive as her classmates. She, too, became adept at using the word processor and its many features including the importing of graphics. In addition, Missy learned to use *Paint Shop Pro*, *PowerPoint*, scanning software, and the CD-ROM reference package,

*Book Shelf.* She regularly searched the World Wide Web for information and downloaded files for later use. Missy was also able to electronically transfer files from home to school and vice versa.

While Missy was willing to work cooperatively and collaboratively with all her classmates, she did not seek out opportunities to assist others. If asked to do so, though, she happily complied. If it was warranted when working with a partner, Missy naturally assisted if she was able to do so. Through e-mail Missy showed initiative in assisting other students in their learning by sending out interesting facts she was learning on her own and sharing them.

Socially, Missy reached out far more through e-mail than she did in person. She spent so much time on line that the family purchased a second phone line (Researcher's Journal, April 17, 1997). Missy used e-mail for another purpose in addition to a medium for social interaction. She utilized the resource to seek help with homework, to ask questions when she was confused. By year's end I was receiving e-mail from her every day.

### **Afterward: Sixth Grade**

#### **Structure of Sixth Grade**

In sixth grade the students moved next door to Hawthorne Middle School. Sixth grade in the middle school was structured differently from fifth grade in the elementary building. Students moved

from room to room as they changed classes for each subject. Their belongings were kept in lockers rather than in the classroom with them. Most classrooms contained no technology. While one computer lab was available, teachers rarely availed themselves of it.

In addition to the many physical and structural changes the sixth graders were expected to adjust to, they also had to take a battery of tests required by the state. Included in the battery were minimum competency tests in reading, composition, and mathematics. A discussion of these tests and their implications, as well as data relating to how each of the four students performed, follows.

### **Literacy Passport Test**

When the four students entered fifth grade, two of them—Joe and Mike—were labeled at risk in three areas. The “at risk” label was defined by performance on three tests administered in fourth grade:

- *Degrees of Reading Power*;
- *Writing Predictor*;
- *Iowa Test of Basic Skills*—Total Mathematics.

Missy was also considered at risk but in written language only. There were no test scores for her from fourth grade so her label was based on her level of performance the previous year as evidenced by information in her permanent record.

During sixth grade all four students were administered the *Literacy Passport Test (LPT)*, as required by state law, which measured their performance in reading, writing, and mathematics. The following table reports how each student performed on each portion of the LPT.

| <b>Student</b> | <b>Reading</b> | <b>Writing</b> | <b>Mathematics</b> |
|----------------|----------------|----------------|--------------------|
| Joe            | Fail           | Fail           | Fail               |
| Lizy           | Pass           | Pass           | Pass               |
| Mike           | Pass           | Pass           | Pass               |
| Missy          | Pass           | Pass           | Pass               |

The LPT is first administered in sixth grade. Its purported purpose is to guarantee that any student entering high school can function at the competency level of a sixth grader. Students who pass any portion of the LPT can forego further testing. Students who fail any portion of the LPT must retake that portion until they do pass. The test is administered twice each year in seventh and eighth grades and during the summer for students who attend summer school. For students failing a portion, remediation in that area is required.

Any student not passing all three parts of the LPT by the end of eighth grade enters high school non-graded or unclassified and cannot participate in any extracurricular activities that require a grade status. These include sports, cheerleading and musical competitions. The student can take high school courses and earn high school credits, but his or her unclassified status remains on the permanent record. By the

end of high school, any student still not passing all three portions of the LPT receive a certificate of attendance rather than a standard diploma.

While Joe did not pass any portion of the LPT, his performance was better than on previous tests. Thus, Joe is showing improvement in achievement, but not enough to pass the LPT. Missy passed the writing portion of the test and is no longer labeled at risk in written language. Mike, previously labeled at risk in all three areas is no longer labeled at risk in any.

It is important to note that the Commonwealth of Virginia has altered its testing program this year. Thus, Joe will not have to pass the *Literacy Passport Test*, but will, instead, be required—as will all students—to earn verified credits for high school courses through a newly instituted *Standards of Learning* testing program.

Other standardized test data cannot be discussed because the state changed from using the *Iowa Test of Basic Skills* to the *Stanford 9*. Comparisons across two different norm-referenced tests cannot be made for the students who were studied.

### **Sixth Grade Survey**

After sixth grade ended, I contacted each of the four students and asked them to complete a short survey. Two responded immediately—Joe and Lizy. The others never responded even though I

made three additional requests. What Joe and Lizy reported, however, is both interesting and telling.

### **Survey Results**

#### **Joe**

In his response to my query about the differences between fifth grade and sixth, Joe addressed social issues. He stated, "We had lockers. It was hard to adjust to a lot of picking." (From this comment I conclude that Joe was referring to the negative interaction between students during class changes. As students move to and from lockers they often "pick" on each other.) Joe did report that he used the computer at home extensively for the writing of reports and poems for his classes in science, social studies, and language arts. Joe said he didn't use his home computer as much as he had in fifth grade because there wasn't as much homework assigned in sixth. In regards to e-mail Joe said that he used e-mail "lots." He reported maintaining contact with family, friends, and teachers from fifth grade through e-mail. Finally, Joe mentioned using his home computer to play games, but he did not delineate specifics.

#### **Lizy**

In her response to me, Lizy also stated that she didn't use the computer as much as in fifth grade, and for the same reason—"there

wasn't as much homework." She went on to describe differences between fifth and sixth grades: "In fifth grade Ms. Penmon and Mrs. McKnight gave us challenges every day. But in sixth grade the teachers had so many students to deal with we didn't get assignments quite as often as we got in fifth grade."

Lizy spoke to using the computer at home. She said, "[I used the computer for] doing reports, and just for fun. I like surfing the net. If there is something that I would like to find out about, I look it up. Sometimes I start looking for one thing and end up somewhere else." She went on to say, "Using the computer made short work of school assignments. The teachers said it was okay to turn in reports that had been typed on the computer." Her response shows that Lizy is pursuing learning in two ways—on her own if there is something she wants to find out about and to fulfill the requirements of school assignments.

In contrast to Joe, Lizy stated she didn't use e-mail much any longer. It was no longer required, so even though she made many attempts to reach out to other students, "maybe one or two will answer me back."

### **Summary**

The effects of fifth grade have been lasting for the two students who responded to the survey. In both cases, the students continued to

use the computer skills they learned in fifth and applied them to work assigned in sixth. While they no longer had the technology available to them throughout the school day, both continued to make use of it at home. This highlights a facet of self-directed learning. No one required the use of the computer any longer. It was now a self-made choice. Lizy extended this by describing how she used the available technology to find information about topics of interest, ones not required by any assignment.

Joe chose to continue to use the technology as a vehicle for social interaction. During fifth grade, Joe and his family had created a network of friends throughout the world to e-mail, and he continued to use the medium for this purpose. Lizy provided evidence that she wanted to continue to reach out to others through e-mail, but found little success. She had not yet developed a method for finding new friends with whom to exchange e-mail.

Neither student mentioned using the computer or e-mail for any type of collaboration. While it can't be ruled out, it is doubtful this occurred since neither mentioned it in their narrative answers to my short survey.

## Chapter 6: Synthesis of the Year's Study

This study was undertaken to discover how a group of fifth grade students and their teacher would adapt to using available information technology as tools for learning. A unique classroom was established, one replete with start-of-the art information technology. Over the course of a school year, I observed the classroom to learn how the available technology could be utilized in a constructivist setting with state-mandated curriculum in place. As need arose, students were introduced to the many tools of information technology that could aid or extend their learning. In many instances students taught themselves, their classmates, their teachers, and their families useful skills as they mastered new ways of accessing, analyzing, using and reporting information. The timeline shown in Figure 7 on the next page illustrates how the year of the study progressed.

## Time Line

| Event                                                                              | September | October | November | December | January | February | March | April | May |
|------------------------------------------------------------------------------------|-----------|---------|----------|----------|---------|----------|-------|-------|-----|
| Lottery is held.                                                                   | •         |         |          |          |         |          |       |       |     |
| Classroom observations                                                             | •         | •       | •        | •        | •       | •        | •     | •     | •   |
| Students selected for the study.                                                   | •         |         |          |          |         |          |       |       |     |
| Collaborative planning with classroom teacher.                                     | •         | •       | •        | •        | •       | •        | •     | •     | •   |
| Model teaching                                                                     | •         | •       | •        | •        | •       | •        | •     | •     | •   |
| Interviews conducted.                                                              |           | •       |          | •        |         | •        |       | •     | •   |
| Hardware is installed in classroom.                                                |           | •       |          |          |         |          |       |       |     |
| Hardware is installed in homes.                                                    |           | •       |          |          |         |          |       |       |     |
| Students use Microsoft <i>Word</i> to create documents.                            |           | •       | •        | •        | •       | •        | •     | •     | •   |
| Students access the World Wide Web.                                                |           | •       | •        | •        | •       | •        | •     | •     | •   |
| Students use CD-ROMs.                                                              |           | •       | •        | •        | •       | •        | •     | •     | •   |
| E-mail software is installed on all machines.                                      |           |         |          | •        |         |          |       |       |     |
| Students use e-mail to submit homework.                                            |           |         |          |          | •       | •        | •     | •     | •   |
| Students use e-mail to collaborate.                                                |           |         |          |          | •       | •        | •     | •     | •   |
| Students use e-mail for social interaction.                                        |           |         |          | •        | •       | •        | •     | •     | •   |
| Students scan photographs and manipulate images.                                   |           |         |          |          |         | •        | •     | •     | •   |
| Students take digital photographs and manipulate resulting images.                 |           |         |          |          |         | •        | •     | •     | •   |
| Students download files from the Internet.                                         |           |         |          |          | •       | •        | •     | •     | •   |
| Students create <i>PowerPoint</i> presentations.                                   |           |         |          |          |         |          | •     | •     | •   |
| Students use <i>Paint Shop Pro</i> to create artwork and to edit resulting images. |           |         |          |          | •       | •        | •     | •     | •   |
| Students attach files to e-mail messages.                                          |           |         |          |          | •       | •        | •     | •     | •   |
| Students create WAV (sound) files.                                                 |           |         |          |          | •       | •        | •     | •     | •   |
| Students transfer files electronically.                                            |           |         |          |          |         |          | •     | •     | •   |
| Students create web pages using Hypertext Markup Language (HTML)                   |           |         |          |          |         |          |       | •     | •   |

**Figure 7: Time line**

At the outset of the school year Samantha Penmon professed to know little about constructivism. She most likely did not realize that her methodology was well grounded in constructivist theory. At one point another researcher in the FIS project requested from Samantha a class syllabus that would illustrate what she planned to teach during the second semester. Her response was that she didn't know the specifics of what she would be teaching in language arts. She related that she would follow state guidelines, but that they were broad. She went on to explain that she would follow the lead of her students and then provided a clear example. For a few years Samantha had chosen to teach a novel that was of high interest to students. During the course of the study, many topics arose that could capture students' interest. One year her class had become fascinated with the Native American perspective of land ownership. Another year a different topic became the focus of additional study. In all cases, Samantha allowed the curiosities and interests of her students to become the focus of lessons that would enhance their skills in reading, writing and speaking. Perhaps without realizing it, Samantha Penmon was adhering to what Dewey had stated in 1897: "The child's own instincts and powers furnish the material and give the starting-point for all education."

The available technology did not drive instruction in the fifth grade classroom. Rather, it enhanced instruction. It allowed all students to seek information on a given topic, but from many different sources with many different results. If conflicting information resulted, Samantha guided the children in determining which was most accurate or relevant.

The interaction between novice and expert highlights Vygotskian theory of social constructivism (1978). At times evident and interesting in this fifth grade classroom was the interplay between the teacher as novice and the teacher as expert. It was not unusual for a student to become the facilitator for the teacher's learning. This was clearly the case when Mike discovered the westward movement homepage and brought the URL to class thus "getting the ball rolling" for the teacher's effective use of World Wide Web resources as part of her instructional repertoire.

Three themes emerged from the data collected and were analyzed for each of the four students whose case studies were presented. In all cases, the students demonstrated that they responded well to using the technology both at school and at home. All four students utilized e-mail as a means of social discourse as well as for purposes of collaboration. In many instances, e-mail illustrated

ways in which students were developing skills that are vital to self-directed learners.

Similar to what Collins reported in 1991, the four students considered in depth during the first year of the Field Initiated Study demonstrated an increase in cooperation with no evidence of competitiveness detected. As reported by Newman (1994); Dwyer, Ringstaff, & Sandholtz (1991) in the Apple Classrooms of Tomorrow (ACOT) studies; Dwyer (1994), West (1995); and Lafer & Markert (1994), the structure of the classroom with the infusion of technology facilitated both cooperation and collaboration. Students readily turned to their partners first and then to other students for assistance when needing help. Fellow classmates were eager and willing to respond to these requests.

McClellan (1994) and Dwyer (1994) recommended pairing students when computers are used in a classroom setting. Their reasoning was twofold. It is more cost effective and pairing facilitates students acquiring skills needed for cooperation and collaboration. In order to collaborate, students must interact socially. In addition, social interaction is needed in mastering certain intellectual skills. In the fifth grade classroom studied here, this was found to be true. All four students studied were willing partners with other classmates and learned to be effective and cooperative collaborators. No incidents of

arguing over use of the technology, or for any other reason, were observed. These enhanced skills of collaboration can serve the children well in the future as they continue their education and enter the work force.

Dwyer (1994) found that students immersed in settings incorporating new technologies increase in their abilities to practice inquiry, collaboration, and problem-solving skills. This was observed many times with all four of the students studied. As the students began to effectively utilize the technology to find and report information, many problems occurred. At times a URL would not function properly. Sometimes a mouse would cease working or a student would forget how to access a given file. In all cases observed, students first tried to solve problems themselves, and then asked their partner for assistance prior to seeking help from a teacher or other student. By year's end the four students studied were well capable of solving their own technological problems and were able, when asked to collaborate with their partners or others, in solving problems their classmates had encountered. This taking ownership of problem solving can carry over into other aspects of the students' lives.

Barr (1990) stated that in order for students to become life-long, self-directed learners, they must be introduced to the tools they will use throughout their lives. Strommen and Lincoln (1992) reported that

how technology is used is important. They advocate "finding appropriate points for integrating technology into a new pedagogical practice, so that it supports the deeper, more reflective self-directed activity children must use." Efforts were made to follow this advice and self-directed learning became a skill that was enhanced for all four students studied. All four effectively utilized the technology available to them at school and at home as they began to pursue knowledge on their own. Many examples of their efforts in pursuing knowledge and sharing what was learned with others through in-class collaboration and e-mail from home were illustrated throughout the case studies.

The technology had a major impact on the facilitation of social discourse and interaction for students living in a rural setting with great distances between residences. Joe, in particular, quite shy and reticent in class, was able to reach out to others through e-mail where he became quite social. For Lizy, who had no telephone in her home until the FIS project provided one, the new medium of e-mail provided her with opportunities for social interaction that she readily used. Missy, new to the school and quite shy, also found that she could both collaborate and interact socially via e-mail. Missy was particularly eager to share new learnings she had discovered on her own.

## Reflections

### Conducting Research

During my year's work with Samantha's class, I learned much about research. My skills as a researcher were honed as I learned how to collect, store, and interpret data. In my daily life I am not as detail oriented as I would like. I quickly learned that being an effective researcher requires a high level of organization and that attention to even minute details is important. Collecting a truckload of data is of little value if there is no thought given to its organization. A mountain of evidence can become overwhelming to sift through. Early on I developed a system of organization that made it much easier to sort through data at year's end in order to determine which was pertinent to the final report.

As I worked in the classroom I learned how to observe. Once I determined the four students I would study, it became easier to focus. I continued to gather evidence about other students when it was pertinent, but became more selective in what I retained. I particularly sought evidence of other students when doing so assisted me in understanding the four that I was studying. I could then compare data between and among students. And while I wanted to home in on four students out of twenty-four, I soon realized that a global understanding of the entire classroom was also important. How the

four students functioned as part of the whole helped me better understand them as individuals.

A proficient and fast typist, I soon learned that gathering information as an observer was easier when using a keyboard. The few handwritten notes I took were transcribed as soon as was feasible. I became facile at memorizing short pieces of dialogue that I also would transcribe a short time afterward.

I learned that equipment can and *will* fail. Many years of classroom experience had me well prepared for this facet of my work. I never allowed equipment failures to get the better of me. Instead, I was able to quickly move in a new direction. Thinking on one's feet is a vital skill for a researcher to have.

Tenacity also serves a researcher well. When plans go awry it can be disheartening. Persevering under adverse conditions can be trying. Not giving up takes courage and heart.

While I cannot directly relate student learning to the use of the technology, I can say that the evidence shows that the technology did no harm. The teacher and students readily adapted to having it available and utilized it well.

### **Lessons for Others**

Of all that I learned during my year of study, the most important lesson for me has been that children can and will far exceed any

expectations we have for them. Having taught fifth graders for many, many years, I had first-hand experience that young students can rise to great challenges. Watching the students in Samantha Penmon's class as they eagerly learned new ways of functioning in a classroom, as well as new ways of acquiring knowledge, and then going on to challenge themselves further, was the most rewarding part of my year's work. Coupled with the rich experience of working with a caring and gifted teacher, I can envision no better learning environment for me to have studied.

The rapid learning pace of the fifth graders had an enormous impact on my own learning. The students taught me much about technology during my time with them. From the students I learned many skills that I now utilize on a daily basis. Because of my interaction with them, I can now use many more kinds of technology than in the past. In true constructivist fashion, I learned these skills because I had a need for them. It is important to remember that in a collaborative learning environment there is not one giver of knowledge. Rather, all participants learn from one another regardless of age or experience.

### **Self Discovery**

A teacher often lives for the "ahas"—those moments when a student's face clearly reflects that a new understanding has occurred. I

always felt successful if I witnessed the moment when a child knew she had gained a depth of awareness. I generally viewed it as a measure of success for both the student and myself. With Samantha's class there was a glut of such moments, more than I knew possible. The learning pace was so rapid that, to me, the "ahas" became mundane. All of us were learning together and were affecting each other's acquisition of knowledge. Observing self-discovery in action was most gratifying.

First, there were the many times when Samantha came to realize the myriad new ways she could effectively utilize the tools of technology that were available in her classroom. Then, there were the children whose energy and excitement with new learning was so evident a plethora of times each day that the classroom seemed to be charged with electricity. The surprise for me, however, was how often I found myself reflecting on my own new learning. What was happening to those around me was happening to me as well. It was sheer joy.

It has always been important to me as an elementary teacher to develop relationships with my students. They were as much my children as they were the children of their parents. In many cases, I was with my students many more hours a day than their parents were. However, whenever I have served in the role of resource teacher, I

have found it difficult to develop sustainable relationships with students. Generally, in my role as resource teacher I would work with students no more than one hour at a time two to three times a week. In Samantha's class this was also true. I quickly knew the children's names and a bit about them, but was unable to become that trusted person with whom they would share a kinship.

That changed dramatically when e-mail became available. Several students chose to use the medium to deepen relationships with me. Electronically they were able to reach out to me and I to them. The e-mail exchanges were able to bridge the gap of my not being in the classroom all day, every day. Several students would use e-mail to share information unrelated to any assignment. For one it was an account of a camping trip. For another it was about a shopping trip and the purchase of new shoes. I would receive photographs, original artwork, and words of encouragement just as I would have had I been in the classroom more often. Shy students often demonstrated witty or insightful behavior through e-mail. Even if I had been their full-time teacher I may never have discovered this aspect of their personalities. Extroverts can overshadow shy students. E-mail provides an outlet for a shy youngster to reach out in ways he or she may not be able to do otherwise.

## **Summary**

Emerging technology will continue to impact education, albeit more slowly than in society at large. The cost of restructuring classrooms to include the needed hardware and software will keep it at bay. Until costs of technology are reduced or until a lack of technology in the classrooms puts American students at great disadvantage, it is doubtful that taxpayers will be willing to assume greater financial support for the inclusion of technology.

### **Future Impacts on Education**

As use of information technology is demonstrably rising in society, it will more naturally appear in classroom settings. Such concepts as e-mail and use of the World Wide Web will no longer be foreign to educators but will be seen as a normal part of everyday life similar to use of the videocassette recorder (VCR). This is partly due to the acculturation of society at large. Public schools have and will continue to reflect what happens in the real world. It is now common to see Web addresses—as well as personalized search engines such as NBC's "snap.com"—appear in advertisements on television.

In addition, since the onset of this study, all students in grades five and eight must now meet a state mandate that requires them to pass paper-and-pencil competency tests relating to educational technology. Teachers, too, have required competencies that must by

met by a not-too-distant deadline. These requirements would not be expected if information technologies were not going to continue to impact public school classrooms.

In my own school division many changes have already occurred in the short time since I gathered data for my study. The infrastructure for technology has grown and is more widely used. The school division now has its own network domain and servers and is no longer an adjunct of the local community networking project. Other uses include the following:

- Fifth grade teachers can access a locally-created multi-media CD-ROM focused on Virginia's participation in the Civil War. The information was loaded onto the server for ease of use.
- It is now common for teachers and administrators to utilize e-mail when communicating rather than to play telephone tag. E-mail addresses are showing up on the business cards of local educators.
- Every school now maintains Web pages.
- Supervisors use listservs to distribute information to teachers and to give teachers a forum for sharing ideas.
- Liquid crystal display (LCD) projectors are utilized in some classroom where teachers project multi-media presentations they have created on their own computers.

- It has become common for students at all levels to word process their homework.
- Large screen televisions in classrooms are often used as presentation media and are driven by computers.

Change is not happening all at once, but at a fairly rapid pace. In many cases, the classroom of today in my school division differs somewhat from the classroom of two years ago. Slowly, information technology—where it is readily available to students and teachers—is subtly transforming how teachers work and students learn. Sadly, lack of hardware limits students' and teachers' ability to effectively use technology that is readily available in most offices and businesses in society at large. Even soda machines have modem access to distributors to report when they are low on drinks.

Thus, information technology in and of itself is not problematic for educators. There can be, however, a large gulf between how a K-12 educator sees an appropriate application of information technology and how a computer scientist envisions its use. In the phrase, "educational technology," the computer scientist often sees the word, "technology," while the teacher sees the word, "educational." In other words, to be effectively utilized in the classroom, the technology does not have to be cutting edge. When the students in this project began correcting each other's spelling and punctuation, this was seen by the

teacher and me to be an enormously successful result of using very mundane technologies such as e-mail and word processing. A computer scientist could overlook the relevance of this action and instead be frustrated that students are not using exotic applications such as Multi-user Domains (MUDs).

Technology is not an end for educators. Instead, technology can provide the teacher with effective tools. Student learning remains the educator's goal with use of information technology as one means to this end. It should be remembered that much can still be accomplished in a classroom of twenty-five students with an old Apple IIe computer and an Internet connection (Matusevich, 1994).

The future use of information technologies in the classroom will most likely focus on digital libraries. A digital library is not merely a collection of electronic information. Rather, it is an organized and digitized system of data that can serve as a rich resource for educators and their students.

More and more information is being converted into digital form that will allow greater and easier access. One example, the Electronic Thesis and Dissertation project at our local university has collaborators from many major universities throughout the United States. All theses and dissertations are submitted electronically and can be made available to anyone in the world with Internet access.

Digital libraries allow educators and their students many options. As an example, students can post their work on the World Wide Web for peer or professional review. Another possibility would be for students to become both consumers and producers of knowledge by creating Web pages for the community at large. A virtual museum that includes multi-media oral histories, scanned photographs, letters, and other historical documents could be established for the local community. Residents often choose to retain family letters and photographs rather than donate them to a standard historical museum. With a virtual museum, however, the owners can retain the artifacts while digitized versions are made accessible to a wide audience. Easy access to primary sources adds a dimension to education that readily available at present.

The unstructured nature of the World Wide Web, however, can create problems for educators. The future probably will hold an answer. There are already projects underway to alleviate the dilemma of content management. Imagine a library with books on shelves in random order with no card catalog available and no librarian to assist you. No human expert has evaluated each book and assigned it into any classification scheme. The World Wide Web is an electronic version of such a library. The unstructured nature of the Web has resulted in bad content management. Search engines are available for seeking

guidance in locating appropriate information, but they are much like a card catalog based on the creator of the catalog having read only the first few words of each book. Services such as Yahoo that organize the plethora of information into a hierarchy that can be browsed easily are greatly needed. Yahoo is limited and is merely a beginning. The inefficiency of the World Wide Web has led to a system similar to the above-mentioned library. This is one example of a need that computer science can solve for educators.

Already available, but not yet in common use, are electronic textbooks that look like a regular text, but actually weighs far less. Each year a student's electronic text can be loaded with up-to-date versions of every textbook he or she will need for that school year. Just coming on the market, these books may hold promise.

K-12 education will most likely be a spin-off recipient of new technologies. However, emerging technology should not be force-fit into a K-12 environment. Rather emerging technology should be appropriately adapted for it. One touchstone might be this: "Is use of the technology the most appropriate and effective way to meet the learning goal?" In order for this to occur, cooperation between computer scientists and K-12 educators is vital. Each group has much to offer the other. The caveat is that neither group should make

uninformed assumptions about the intricacies of the milieu in which the other group works.

### **Further Research**

The study of this class continues for three years as the students move to middle school. They will retain the hardware they have at home, but will be in regular classrooms with little, if any technology available to them. What happens during this time will make an interesting study. At one point, Samantha stated to me, "I could never go back to teaching the way I used to." How will the students adjust to having to revert to the old way of being in school? They surely cannot go back to being who they were before the study began. What will happen at home? Will the students continue to use the available technology as they always have? Will they utilize it in new ways? Will their knowledge impact their teachers or other students who did not participate in the study? What impact did the computer in the home have on the study? Would the results have been the same if the students had no available technology at night and on weekends? Could the technology be used to facilitate home-school communication? What effects would the introduction of technology in the classroom and at home have on family patterns of interaction and leisure-time pursuits. Would television watching decrease? Finally, would other teachers adapt the same way Samantha did to this type of environment, an

environment where there are state-of-the-art tools available, an environment where students' interests and needs drive the planning of instruction? If so, what are the implications for staff development for teachers?

Other possibilities for further study include a focus on how individual differences such as learning styles impact student achievement; how self-directed learning transfers to in-school and out-of-school behaviors.

## References

- Bagley, C., & Hunter, B. (1992). Restructuring, constructivism, and technology: Forging a new relationship. Educational Technology, (July), 22-27.
- Bangert-Drowns, R. L., Kulik, J. A., & Kulik, C. C. (1985). Effectiveness of computer-based education in secondary schools. Journal of Computer-Based Education, 2(3), 59-68.
- Barr, D. (1990). A solution in search of a problem: The role of technology in educational reform. Journal for the Education of the Gifted, 4(1), 79-95.
- Bracewell, R., & Laferriere, T. (1996). The contribution of new technologies to learning and teaching in elementary and secondary schools. 1-43.
- Brownell, G. and McArthur J. (1996) A preliminary report: Robotics and collaborative learning in a sixth grade classroom. Technology and Teacher Education (SITE), Phoenix, Arizona, March 13-16, 1996. Charlottesville, VA: Association for the Advancement of Computing in Education. XVI et 1063 p.
- Bruner, J. S. (1971). The relevance of education. NY: W. W. Norton and Co.
- Campoy, R. (1992). The role of technology in the school reform movement. Educational Technology, (August), 17-22.

- Capper, J. (1988). Computers and learning: Do they work? A review of research. Center for Research into Practice.
- Collins, A. (1991). The role of computer technology in restructuring schools. Phi Delta Kappan, (September), 28-36.
- Dewey, J. (1897). My pedagogical creed. New York: E. L. Kellog and Company.
- Dewey, J. (1916). Democracy and education: An introduction to the philosophy of education. New York: Macmillan.
- Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1991). Changes in teachers' beliefs and practices in technology-rich classrooms. Educational Leadership, (May), 45-52.
- Dwyer, D. C. (1994). Apple classrooms of tomorrow: What we've learned. Educational Leadership, 51(7), 4-10.
- Guthrie, L. F., & Richardson, S. (1995). Turned on to language arts: Computer literacy in the primary grades. Educational Leadership, 53(2), 14-17.
- Heidmann, A., Waldman, D., & Moretti, B. (1996) Using Multimedia in the classroom. International Conference on Technology and Education.

- Herman, J. L. (1994). Evaluating the effects of technology in school reform. In B. Means (Ed.), Technology and education reform: The reality behind the promise. (pp. 133-167). San Francisco: Jossey-Bass.
- Jones, B. L., & Maloy, R. W. (1996). Schools for an information age: Reconstructing foundations for learning and teaching. (First ed.). Westport, CT: Praeger.
- Jones, I. (1994). The effect of a word processor on the written composition of second-grade pupils. Computers in Schools, 11(2), 43-54.
- Joram, E., Woodruff, E., Bryson, M., & Lindsay, P. H. (1992). The effects of revising with a word processor on written communications. Research in the Teaching of English, 26(2), 167-193.
- Kulik, C. C., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. Computers in Human Behavior, 7, 75-94.
- Lafert, S., & Markert, A. (1994). Authentic learning situations and the potential of Lego TC Logo. Computers in Schools, 11(1), 79-94.
- Mann, C. (1994). New technologies in gifted education. Roeper Review, 16(3), 172-176.

- Matusevich, M. (1996). Learning and teaching in a virtual school. In A. Cohill and A. Kavanaugh (Eds.), Community networks: Lessons from Blacksburg Virginia (pp. x-y). Norwood, MA: Artech House.
- Matusevich, M (1994). Telecommunications projects.  
<<http://wendolene.dlib.vt.edu/melissa/projects.html>>.
- McKinnon, D. H., Nolan, C. J. P., & Sinclair, K. E. The Freyberg integrated studies project in New Zealand: A longitudinal study of secondary students' attitudes towards computers, their motivation and performance. Vol. 2. Grand Prairie, TX: International Conference on Technology.
- McLellan, H. (1994). Interactions of student partners in a high school astronomy computer lab. Computers in Schools, 11(1), 29-41.
- McMahon, T. A., & Duffy, T. M. Computers extending the learning environment: Connecting home and school. ERIC.
- Merriam, S. B. (1988). Case study research in education. San Francisco, CA: Jossey-Bass.
- Newman, D. (1994). Computer networks: Opportunities or obstacles? In B. Means (Ed.), Technology and education reform. The reality behind the promise. (pp. 57-80). San Francisco: Jossey-Bass.
- O'Neil, J. (1995). On technology and schools. A conversation with Chris Dede. Educational Leadership, 53(2), 6-12.

- Owsten, R. D., Murphy, S., & Wideman, H. H. (1992). The effects of word processing on student's writing quality and revision strategies. Research in the Teaching of English, 26(3), 249-276.
- Papert, S. (1980). Mindstorms: Children, computers, and powerful ideas. NY: Harvester Press.
- Piaget, J. (1954). The construction of reality in the child. New York: Basic Books.
- Piaget, J., & Inhelder, B. (1969). The psychology of the child. London: Routledge & Kegan Paul.
- Piaget, J. (1973). To understand is to invent. New York: Grossman.
- Raywid, M. (1990). The evolving effort to improve schools: Pseudo-reform, incremental reform, and restructuring. Phi Delta Kappan, , 139-143.
- Riel, J. (1995). The integrated technology classroom: Building self-reliant learners. Boston: Allyn and Bacon.
- Riel, M., & Levin, J. Educational electronic networks: How they work (and don't work). Chicago, IL: American Educational Research Association.
- Riel, M. Telecommunications: A tool for reconnecting kids with society. Jerusalem: International Symposium on Telecommunications in Education.

- Riel, M. (1990). Computer-mediated communication: a tool for reconnecting kids with society. Interactive Learning Environments, 1(4), 255-263.
- Roblyer, M. D. (1996). The constructivist/objectivist debate: Implications for instructional technology research. Learning and Leading with Technology, 24, 12-16.
- Rockman, S. (1990) Telecommunications and restructuring: Supporting change or creating it. Minneapolis, MN: ERIC ED331497.
- Scardmalia, M., Bereiter, C., Brett, C., Burtis, P. J., Calhoun, C., & Lea, N. S. (1992). Educational applications of a networked communal database. Interactive Learning Environments, 2(1), 45-71.
- Sheingold, K., & Hadley, M. (1990). Accomplished teachers: Integrating computers into classroom practice. New York: Bank Street College of Education.
- Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. Phi Delta Kappan, 73(1), 17-27.
- Silverman, B. G. (1995). Computer supported collaborative learning (CSCL). Computers and Education, 25(3), 81-91.
- Soloway, E., & Wallace, R. (1997). Does the Internet support student inquiry? Don't ask. Communications of the ACM, 40(5), 11-14.

- Strommen, E. F., & Lincoln, B. (1992). Constructivism, technology, and the future of classroom learning. Education and Urban Society, 24(4), 466-476.
- US Congress, Office of Technology Assessment (1995) Teachers and technology: Making the connection. Washington, DC: Government Printing Office. IX et 292 p. See chapters I & II.
- Van Dusen, L. M. & Worthen, B. R. (1995) Can integrated instructional technology transform the classroom? Educational Leadership, 53 (2), 28-33.
- Vygotsky, L. (1962). Thought and language. Cambridge: Massachusetts Institute of Technology Press.
- Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.
- West, P. (1995) With computers, Apple project finds less may be more. Education Week XV (11), 6.
- Wood, D. (1995). Theory, training and technology: Part I. Education and Training, 37(1), 12-16.

## Vita

Melissa N. Matusevich was reared in Gulfport Florida where she spent many hours whiling away time on the sandy beaches of the Gulf of Mexico. In 1966 she was graduated from Boca Ciega High School, and in 1970 she earned a Bachelor of Arts degree from the University of Florida. After teaching in Blacksburg, Virginia for many years, she completed a Master of Science degree in 1983. Later, she accepted the position of Supervisor of Programs for the Gifted, but after three years returned to her first love, teaching.

In 1994 she entered the School Leaders Program at Virginia Tech and at the same time accepted the position of Instructional Supervisor for Montgomery County Public Schools, Virginia, where she has labored in many capacities for almost thirty years. In her last years of teaching she became fascinated with the power of the Internet and the learning possibilities it opened to her students. During this time she conducted many exciting Internet projects that led to her students becoming more globally aware. Building on this experience, she chose to focus her dissertation on applications of information technology within the required curriculum of a fifth grade class. The study which became the basis of this dissertation illustrates how well educational technology can be adapted for use in a public school classroom.