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AUTHOR Ruberg, Laurie; And Others
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ABSTRACT

This paper examines the impact of digital technologies on an elementary school classroom. The following topics are addressed: (1) how classrooms were physically adjusted to incorporate new digital technologies; (2) the context and content areas in which students used these technologies, based on observation, teacher interviews, and teacher responses to a final survey; (3) and teacher and student attitudes towards increasing use of digital technologies in the classroom. Teachers used computer-assisted instruction in nearly all subject areas for drill and practice, simulations, and word processing. The teachers felt that students responded positively to instructional activities on the computers. Students liked working on their own with the computers; they specifically liked using computers for games, information searches, programs that rewarded a good score on a drill by a playing a game, and looking up definitions while reading. When asked how to improve instructional applications of technology in the classroom, teachers suggested more computers, more training, and more software. Based on this observation of the school, within a supportive and collaborative environment, it is concluded that teachers are interested in using digital technologies in their classrooms. (Contains 2 references.) (JLB)

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The Impact of Digital Technologies on the Elementary School Classroom

by Laurie Ruberg

Glenda Rose Scales

Jan Nesper

Virginia Tech
College of Education, Curriculum & Instruction
806 Cambridge Road
Blacksburg, VA 24060

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Introduction

This discussion will provide a summary of the information obtained and lessons learned from a five months participant observation of technology at a public, intermediate school located in southwest Virginia¹. In order to increase our understanding of the impact of digital technology on a typical elementary school classroom, we sought a situation in which we could observe students using traditional and newly integrated instructional media within their situated learning environment². Likewise, we sought a situation in which we could observe and interact with teachers as they move between traditional and digital technologies.

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²By *situated learning environment* we are referring to the definition of this concept by Brown, Collins, and Duguid (1989) which suggests that a situated learning environment is one where learning is an active process which takes place in the context of a realistic setting.

The school we selected for our research was ideally suited for several reasons: (1) one of the authors, Jan Nesper, had already spent several months constructing relationships with the principle, teachers, staff, and students at this school for other research interests; (2) this school encouraged its teachers to experiment with technology and teachers' efforts to incorporate new technologies were encouraged, praised, and modeled; and (3) this school practices a "whole language" approach to teaching which emphasizes student collaboration and cooperative group work and de-emphasizes direct instruction.

This paper describes: (1) How the classrooms we observed were physically adjusted to incorporate new digital technologies. (2) The context and content areas in which students used these technologies (based on observation, teacher interviews, and teacher responses to a final survey). (3) Teacher and student attitudes towards increasing use of digital technologies in the classroom.

Background to this Study

The emergence of digital communication has led to many dramatic changes in how we seek, store, and share information. The adoption of electronic discourse as a more common mode of communication is changing the traditional concept of reading to include non-printed texts such as computer and television screens and movies. Observing the impact of electronic technologies on how teachers and students work together requires careful consideration of the physical indicators of change as well as looking at individual, personal, psychological, and philosophical responses to change.

Current analysis of the impact of electronic technologies on the organization and structure of schools reflects the depth of influence networked digital technologies will have on the organization of school environments: "Simply hooking teachers and/or students together via network communications is insufficient; developing engaging dialogues requires a carefully structured social organization of technology" (Hawkins, 1993, p. 30). We chose to explore how the classrooms respond to new technologies by observing activities in real classrooms to see how new digital technologies affect the ways teachers and students work together.

Physical Adjustments to Incorporate New Technologies

Each of the classrooms in this school have the student desks arranged in small group clusters combining five to six desks. This layout facilitates student group work and variable pacing of tasks and activities that occur throughout the day. Figures 1 and 2 illustrate the cluster of three or four computers isolated at the back or off to the side of the room to form a separate group work area which students may use individually as their work is completed or move to as a group to fulfill an assignment involving use of the computer.

However, just as computer technology continues to evolve making brand new equipment dated within a few months, the organization of the classrooms we observed was not static. The school introduced a new multimedia system which was situated on a movable cart. A picture of this system is shown in Figure 3. At first, this multimedia system (which included a MAC LCIII with CD-ROM

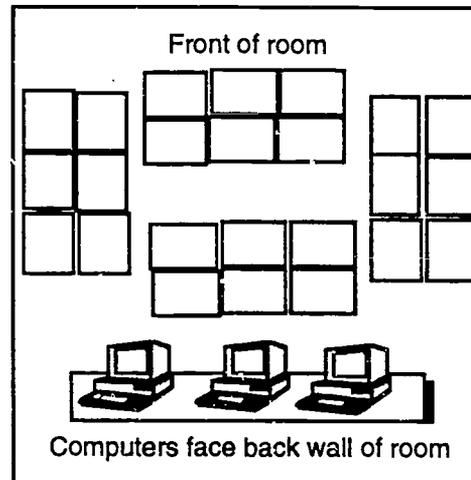


Figure 1: Layout of typical classroom showing computers placed outside the normal classroom group activities with not enough computers present for a normal-sized student group to work individually on computer.

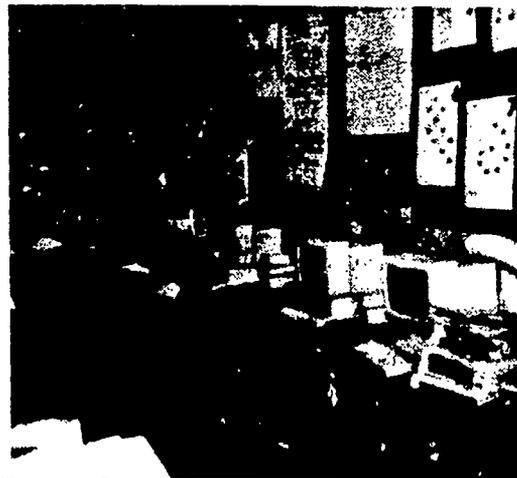


Figure 2: Three computers along side wall of classroom

drive, scanner, and laser printer) was located in the principle's office and teachers, a select group of students, and the principle spent time getting to know what this equipment could do. With support, direction, and encouragement from the district technology supervisor teachers, students, and the principle began creating simple multimedia programs. Gradually the multimedia system was moved in and out of different classrooms for presentations or small group projects. Next year this school will have two more movable multimedia work stations so that each grade has a system which two or three teachers can share.

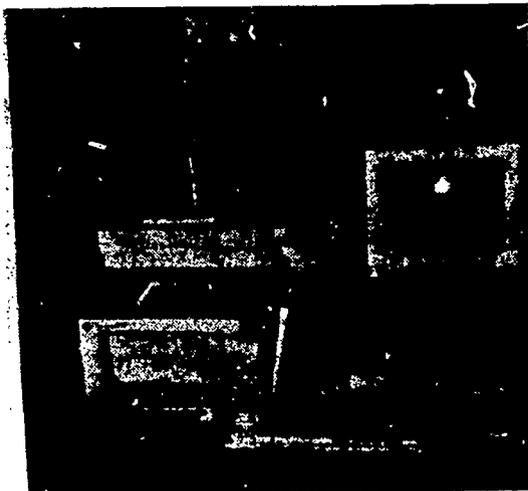


Figure 3: Multimedia workstation on movable cart. Picture shows Macintosh LCIII, (with keyboard and mouse) external CD-ROM drive, color monitor, laser printer, and color scanner. A video camera is laying on top of the scanner.

Teacher Responses Towards Computing in the Classroom

Teachers at this school seem to be using computer assisted instruction in nearly all subject areas. Those areas in which teachers felt that they didn't have adequate computer-based instructional material were in the subject area of health education. All teachers were using the computers in their classroom for *drill and practice, simulations, and word processing.*

activities. A few teachers were using interactive laser discs and CD-ROM programs with their students. Using these technologies took more planning and coordination with other teachers and with the school librarian because the laser disc player and CD-ROM player were not available in every classroom and had to be shared amongst two or three other teachers.

We also asked teachers: "How do you select technology-based instructional programs for your students?" Most teachers responded that they select their computer-based instructional programs based on what's already on the electronic network within the school. Recommendations by colleagues and software catalogs are also prevalent ways in which teachers select technology-based programs. As one teacher commented, she selects software on her own "when given a chance." Another teacher replied that, "I try to purchase materials that fit specific reading/writing needs of my students from companies whose reliability I am familiar with."

Instructional activities on the computer vary greatly in terms of the method of instruction, level of interactivity, use of visuals, amount of feedback, etc. We asked teachers to rate their students reactions to the following different types of programs: (1) drill and practice; (2) simulations; (3) word processing; (4) interactive laser disc; (5) hypermedia; and (6) information retrieval systems such as CD-ROM, VAPEN (a telecommunications network available to all public school teachers in Virginia).

All but one teacher responded that all students liked drill and practice exercises--one teacher responded that "some like it." The teachers who used computer simulation exercises with their students unanimously believed that all students like this type of computing activity, however, not as many teachers are using simulations as use drill and practice exercises. A smaller portion of teachers initiate word processing activities with their

students, and teachers view student responses to this activity as much more mixed though still positive. Generally, teachers' felt that students like to do word processing on the computer.

The number of teachers using interactive laser discs, hypermedia, and information retrieval technologies with their students is considerably less. These technologies are new to the teachers. At this school there seemed to be several lead teachers who were comfortable with trying out new technologies and were very open with sharing their experiences with their peers. The principle at this school encouraged teachers to test out these new technologies and encouraged teacher collaboration and sharing at the weekly staff meetings. All the teachers at the school were confident that their students typically responded very positively to instructional activities using the computer.

We asked teachers whether they believed that all students respond equally well to computer-based instructional activities. As an extension to this question, we asked what individual traits seem to make a student more inclined to do better work on the computer than in other classroom activities? Teachers expressed diverse opinions in their response to this question--partly because each teacher seemed to interpret the question somewhat differently. The responses show each teachers' observation of her students as they interact with content material on the computer and suggest some areas worthy of further research:

No. I believe students who are not strong visual learners have difficulty...

No. Interest level, fear of making a mistake may hinder or slow the student down in interaction with the computer but eventually they get involved. Teacher attitude toward computers may influence the student.

Advanced in academic areas do better -- Chapter 1 students also do better -- Don't know why, but requires less stress with writing, etc.

The students' initial understanding of a concept has an impact on their interest [in a] given software. There is still a need for direct instruction.

Two additional questions we asked teachers addressed how teachers: (1) physically managed their students' work on the computer: whether they had students working primarily individually, in small groups, or used the computer to present information to large groups (the whole class); and (2) their own personal experiences using the computer for storing/presenting instructional material, communicating with peers, managing classroom records, and recreational activities.

We found that teachers primarily use the computer for individualized work and for small group activities. At this point in time, no teachers were using the computer for large group or whole class activities.

Nearly all of the teachers responded that they use the computer to present instructional material to their students. Nearly forty percent of the teachers reported that they also used the computer to develop instructional material for their students. A small percentage of this group of teachers are using the computer to manage classroom records, test scores, lesson plans, etc., but several teachers said they would like to do so in the future. Nearly forty percent of the teachers reported that they use the computer for recreational activities and other personal activities not mentioned. One teacher described herself as a "video game freak!!"

We asked teachers to describe what makes the new digital technologies so popular with their students. Many teachers thought students liked using the computer

because it is like television and video games. Other teachers thought that the individualized interactivity provided students with helpful, immediate feedback. A selection of some of teacher responses illustrates the range of teacher attitudes towards computers:

A modality that is often new to them. Fits today's society - T.V.!! Nintendo!!

When a student is working on computer, they are actively involved, get immediate feedback and [the activity] is more fun because most of the programs that I use have lots of graphics and games.

The students get excited seeing their correct responses highlighted on the computer screen. The excitement increases when the transfer of knowledge is used with the computer.

I enjoy allowing my students to experience technology as it is another medium to acquire or build knowledge of all subject areas. This also lays a technological foundation for the students' future. Children enjoy the technology as it is hands-on learning and is a different medium.

Student Attitudes Towards Computing

We modified the survey distributed to the teachers and gave it verbally to small groups of students from the third, fourth, and fifth grades. The students we interviewed were all volunteers and were happy to be released from class for a few moments. Students were also intrigued by the notebook computer which we used to step through the interview questions. Despite these intervening variables, students seemed comfortable and eager to share their opinions.

When asked what subject areas are more suited to be taught via computer, students suggested science and math programs and seemed to unanimously agree on these. Some students seemed to love writing on the computer, and others clearly did not. Specific aspects of using the computer that students liked were: games, information searches, programs that give a reward of playing a game for an interval of time when they score well in a computing drill and practice program, and being able to search for definitions while reading.

Clearly what all students liked about computing activities is that they enjoy working on their own. In the students own words:

Being able to have a longer amount of time to play or learn by yourself, with the computer helping you learn.

Other people sort of get in your way or tell you what answers to put in.

All students we spoke with expressed a preference for being able to move through a subject area at their own pace. However, the students we interviewed recognize that computers are not as well liked by all their friends. The students who have more experience with computers suggested that some of their friends and peers "don't understand the technology and don't know how to use it."

How to Improve Instructional Applications of Technology in the Classroom

We asked teachers to tell us what they would wish for to improve instructional applications of technology in their classroom. Teachers' responses were fairly similar on this topic: more computers, more training, and more software. All the teachers responding to this survey had personal goals for improving their experience and comfort

level with the new technologies. Some teachers also wanted to see their students having access to a computer at home so that they also would be more comfortable with technology.

Generally, teachers' responses to this survey were very positive and reflect the overall enthusiasm towards new technologies at this school. The attitude of the principal who encouraged teacher experimentation with technology also influenced the responses we received. However, moving to increased use of digital technologies is not easy and many teachers voiced their frustrations with some new equipment during conversations in the lunchroom or in private conversations. As one teacher commented in her survey: "Computers are very helpful when everything goes well. When there are problems, however, it seems that a lot of time is wasted."

The experience of observing teachers' use of technology at this school shows that within a supportive, collaborative environment, teachers are interested in using digital technologies in their classroom. The changes in the social organization of the classroom will come gradually as many issues in this regard are yet unknown. While one teacher emphasizes, "There is still a need for direct instruction." Another teacher looks toward ways to "Make teachers more at ease with 'lessening control' of direct instruction to let children use computers freely all day!" Both opinions suggest that as teachers incorporate more technologies into their students' learning environment, instructional uses of digital media will vary greatly.

Digital technologies can support many different styles of teaching and learning. Our observations of and discussions with teachers at one elementary school have shown that the same technology can be successfully used in different ways by different teachers. Students express an interest in exploring all avenues of digital technology because of its

interactive quality and individualized pacing.

The portrayal of technology use in this one school described here represents a snapshot documentation of a moment in time. Teacher and student interactions with technology will be considerable more sophisticated even several months after these observations were made. We hope to revisit this school again and with students' and teachers' permission we will again capture a snapshot of attitudes towards and ways of using digital technologies in the elementary classroom.

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